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JAPANESE [JP,2001-244878,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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[Translation done.]

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CLAIMS

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[Claim(s)]

[Claim 1] CDMA migration communication system characterized by abolishing the difference of the communication link quality between said two or more base stations by making the transmitted power from said two or more base stations to the mobile station in said software hand off field differ in the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field.

[Claim 2] It is the CDMA migration communication system characterized by to be constituted so that a limit may be given to the transmitted power to the mobile station in said software hand off field which connects said base station with this base station in the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit when [ that ] it gets down and the communication link quality of a circuit has deteriorated to the mobile station in a software hand off field.

[Claim 3] It is the CDMA migration communication system characterized by to be constituted so that a limit may be given to the transmitted power to the mobile station in said software hand off field which gets down, and connects said base station with this base station in the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit when [ that ] the total transmitted power of a circuit is more than a default to the mobile station in a software hand off field.

[Claim 4] In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field It gets down, and in the information about the communication link quality or its total transmitted power in a circuit, said each base station is constituted so that a base station may be transmitted to the control station which has jurisdiction. Said control station From each base station under the jurisdiction, get down and it is based on said information about the communication link quality or the total transmitted power in a circuit. CDMA migration communication system characterized by being constituted so that the information which controls the transmitted power to the mobile station in the software hand off field linked to the base station may be created and transmitted to said each base station.

[Claim 5] In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field The mobile station in said software hand off field measures the communication link quality of the signal from said two or more base stations which have transmitted the same signal to a local station. CDMA migration communication system characterized by being constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations according to the measured this communication link quality.

[Claim 6] In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field The mobile station in said software hand off field

measures the amount of interference from said two or more base stations which have transmitted the same signal to a local station. CDMA migration communication system characterized by being constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations according to the measured this amount of interference.

[Claim 7] In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field The mobile station in said software hand off field measures the communication link quality of the pilot signal from said two or more base stations which have transmitted the same signal to a local station. CDMA migration communication system characterized by being constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations according to the communication link quality of the measured this pilot signal.

[Claim 8] In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field Said each base station is constituted so that the information in a local station which gets down and shows circuit communication link quality or the total transmitted power of a local station may be reported to a mobile station. The mobile station in said software hand off field It is based on said going-down circuit communication link quality or the total transmitted power reported from said two or more base stations which have transmitted the same signal to a local station. CDMA migration communication system characterized by being constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] About code division multiple access (Code Division Multiple Access, henceforth, CDMA) migration communication system, it gets down and especially this invention relates to transmitted power control by the circuit.

[0002]

[Description of the Prior Art] In recent years, the CDMA migration communication mode adapting spectrum spread system attracts attention. In the CDMA migration communication mode, since all stations use the same frequency, generally the software hand off is adopted. This software hand off is the technique of realizing a smooth hand off when the mobile station which is near a cel boundary connects with two or more base stations at coincidence, and it is the description that the hits of the communication link produced at the time of a hard hand off can be prevented. In a CDMA migration communication mode, since the same frequency is used, implementation of a software hand off is easy.

[0003] One method of the software hand off in a CDMA migration communication mode is explained with reference to drawing 5. In drawing 5, BS1, BS2, and BS3 show the base station, and the signal (it is called a pilot signal) for identifying the base station is always transmitted from each base station. A mobile station measures the received power of each pilot signal, and this received power chooses the greatest base station as a connection place base station. Among drawing, when pilot signal transmitted power in a base station BS 1 is set to PP1, the received power is expressed like  $PP1 \times R - K\alpha$ . Here, R shows attenuation according [ accord / the distance from a base station and K / an attenuation coefficient / alpha ] to a building etc.

[0004] The mobile station which exists near a cel boundary (location where the pilot signal received power from two or more adjoining base stations becomes the same) specifies two or more base stations as a connection place. Some following methods are proposed as the approach of this assignment. They are the method which selects the base station where lower limit  $L_{low}$  of software hand off level is set up in so that it may illustrate, and pilot signal received power becomes more than lower limit  $L_{low}$ , the method which selects the base station where upper-limit  $L_{up}$  of software hand off level is set up in so that it may illustrate, and pilot signal received power becomes between lower limit  $L_{low}$  and upper-limit  $L_{up}$ , or the method which prepares a limit in the time amount in a software hand off condition. In drawing 5, the example of the method which selects the base station where pilot signal received power becomes more than lower limit  $L_{low}$  as a connection place is shown, and the field decided to be this appearance is made into the software hand off field.

[0005] Signal composition between the mobile station in a software hand off field and two or more base stations linked to the mobile station is performed as follows, for example. By the uphill circuit, it is received and the signal from the mobile station in a software hand off condition gets over in two or more base stations to connect. The signal to which it restored is transmitted to the control station (or exchange) which generalizes a base station. In a control station, the communication link quality or power of a signal sent from two or more base stations is measured,

and communication link quality chooses the good or high signal of power. That is, in an uphill circuit, selection composition of the signal from the mobile station in a software hand off condition is carried out. The same signal is transmitted towards the mobile station in a software hand off condition from two or more base stations which it gets down and are connected by the circuit on the other hand. The phase of each signal and a time delay are amended and compounded in a mobile station. That is, it gets down and the maximum ratio composition of a signal by which simultaneous transmission is carried out from two or more sets ground offices is performed by the circuit.

[0006] The former to the mobile station in such a software hand off condition gets down, and transmitted power control by the circuit is explained with reference to drawing 6. In addition, such DS / a CDMA system that got down and used \*\*\*\*\*, Naomasa Yoshida, and "software handover about transmitted power control by the circuit get down, and it is indicated by circuit capacity" and 1995 year Institute of Electronics, Information and Communication Engineers communication link society convention SB-4-3. In drawing 6, they are a mobile station in a software hand off field, and the base station which MS\_A connects with BS1 and BS2 connect with this mobile station MS\_A. From base stations BS1 and BS2, the same signal is transmitted for mobile station MS\_A. Transmitted power of the signal for MS\_A in each base station is set to TP1 and TP2. Generally TP1 and TP2 become this power. In mobile station MS\_A, the signal from both base stations is received, and those phases and time delays are amended and compounded. The signal power after composition is measured and it considers as signal power RPt. Signal power RPt is measured with the reference value RPo beforehand set up as a power reference value. In the power control information generation section (PC Information) 1 of mobile station MS\_A, from both comparison, the transmitted power information (PC\_Inf) for raising transmitted power, when the signal power RPt is lower is created, when the signal power RPt is higher, the transmitted power information (PC\_Inf) for lowering transmitted power is created, and as a drawing destructive line shows, it transmits to each base stations BS1 and BS2 through an uphill circuit.

[0007] In the mobile station power control sections (MS Power Control) 12 and 22 which control the transmitted power to this mobile station MS\_A, based on the this transmitted transmitted power information (PC\_Inf), the transmitted power of the signal for mobile station MS\_A is controlled by each base stations BS1 and BS2, and the transmitted power TP1 and TP2 of the signal for mobile station MS\_A transmitted from the signal transmitting sections 11 and 21 is updated in them. Since the transmitted power information (PC\_Inf) transmitted to base stations BS1 and BS2 is common, the amount of updating of the signal power for mobile station MS\_A in each base station becomes the same, and it does not change that both the transmitted power TP1 and TP2 after updating is the same value. In addition, in the example shown in drawing 6, although considered as the configuration which creates transmitted power information (PC\_Inf) by the comparison of the measured value RPt of the signal power after composition, and the reference electrode value RPo, it is good also as a configuration which measures the communication link quality of the signal after composition, compares this measured value with the criteria quality value set up beforehand, and creates the transmitted power information (PC\_Inf) mentioned above.

[0008]

[Problem(s) to be Solved by the Invention] In actual migration communication system, since traffic volume (the number of mobile stations and total amount of the amount of data) is greatly influenced of the environments (a skyscraper, road, etc.) of the location, or population distribution and the configuration of a cel also becomes uneven for every cel, the traffic volume which one cel takes charge of serves as an ununiformity for every cel. Such heterogeneity produces the difference in the communication link quality between cels, and reduces the effectiveness as the whole system. Moreover, when a communication link quality difference is between cels in this way, it is not necessarily efficient that the base station to connect pays the same transmitted power to the mobile station in a software hand off field. That is, a software hand off field is near a cel boundary, and the mobile station location is distant from the base station, and it is expected that the interference from an adjoining base station is also large. For

this reason, in a base station, large power will be paid to the mobile station of a software hand off condition. In the base station where it got down and the communication link quality of a circuit has deteriorated, carrying out a power burden to the mobile station in a software hand off field causes the further communication link quality degradation.

[0009] Then, this invention can lessen the communication link quality difference between cels, and aims at offering the CDMA migration communication system which can raise the effectiveness as the whole system while it gets down and it controls degradation of the communication link quality of a circuit.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the CDMA migration communication system of this invention abolishes the difference of the communication link quality between said two or more base stations to the mobile station in a software hand off field in the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit by making the transmitted power from said two or more base stations to the mobile station in said software hand off field differ. Moreover, to the mobile station in a software hand off field, in the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit, when [ that ] it gets down and the communication link quality of a circuit has deteriorated, said base station is constituted so that a limit may be given to the transmitted power to the mobile station in said software hand off field linked to this base station.

[0011] Furthermore, to the mobile station in a software hand off field, in the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit, said base station is constituted so that a limit may be given to the transmitted power to the mobile station in said software hand off field which it gets down, and is connected with this base station when [ that ] the total transmitted power of a circuit is more than a default. In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again It gets down, and in the information about the communication link quality or its total transmitted power in a circuit, said each base station is constituted so that a base station may be transmitted to the control station which has jurisdiction. Said control station From each base station under the jurisdiction, get down and it is based on said information about the communication link quality or the total transmitted power in a circuit. It is constituted so that the information which controls the transmitted power to the mobile station in the software hand off field linked to the base station may be created and transmitted to said each base station.

[0012] In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again The mobile station in said software hand off field measures the communication link quality of the signal from said two or more base stations which have transmitted the same signal to a local station. It is constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations according to the measured this communication link quality. In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again The mobile station in said software hand off field measures the amount of interference from said two or more base stations which have transmitted the same signal to a local station. It is constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations according to the measured this amount of interference.

[0013] In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again The mobile station in said software hand off field

measures the communication link quality of the pilot signal from said two or more base stations which have transmitted the same signal to a local station. It is constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations according to the communication link quality of the measured this pilot signal. In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again Said each base station is constituted so that the information in a local station which gets down and shows circuit communication link quality or the total transmitted power of a local station may be reported to a mobile station. The mobile station in said software hand off field It is constituted so that the information which directs the change in said transmitted power [ as opposed to / get down and / based on circuit communication link quality or the total transmitted power / to these two or more base stations / a local station to an individual exception ] reported from said two or more base stations which have transmitted the same signal to a local station may be created and transmitted.

[0014]

[Embodiment of the Invention] First, with reference to drawing 1 , the situation of control of transmitted power to the mobile station in the software-off hand off field in the CDMA migration communication system of this invention is explained. In drawing 1 , the mobile station with which MS\_A is located in a software hand off field, and BS1 and BS2 are the base stations linked to this mobile station MS\_A. From base stations BS1 and BS2, the signal same for mobile station MS\_A is transmitted. A base station assigns transmitted power for [ each ] mobile stations so that all the mobile stations to connect may have the same going-down circuit communication link quality. As mentioned above, in mobile station MS\_A, the phase and time delay of the same signal which were received from base stations BS1 and BS2 are amended, and these are compounded and it receives. Although transmitted power required in order that the single base station which the mobile station has connected may satisfy predetermined communication link quality in that mobile station is paid when the mobile station is located in locations other than the inside of a software hand off field, when the mobile station is located in a software hand off field, two or more base stations which this mobile station connects will pay jointly.

[0015] Here, in the cel of a base station BS 1, there is little traffic volume and it gets down, and the communication link quality in a circuit is good, and by the cel of a base station BS 2, traffic volume increases and suppose that the communication link quality deteriorated. In such a case, in the former, mobile station MS\_A in a software hand off field is received. Both the base stations BS1 and BS2 linked to it pay transmitted power at same rate, and it sets to this invention to having been referred to as  $TP1=TP2$ . As  $TP1>TP2$ , it gets down, the burden rate of the good base station BS 1 of the communication link quality of a circuit is increased, and it controls to decrease the burden rate of a base station BS 2 that communication link quality deteriorated. Thus, by making the transmitted power from two or more base stations which receive the mobile station in a software hand off field differ, the transmitted power TP 2 for mobile station MS\_A in the base station BS 2 where it got down and the communication link quality in a circuit deteriorated can be decreased, and it becomes possible to improve degradation of the communication link quality in a base station BS 2. Moreover, reduction of the signal received power in mobile station MS\_A accompanying this can be compensated by the increment in the transmitted power TP 1 for mobile station MS\_A in the good base station BS 1 of communication link quality, and can secure predetermined communication link quality in mobile station MS\_A. In addition, in a base station BS 1, although it becomes degradation of some communication link quality by the increment in the transmitted power TP 1 for mobile station MS\_A, since the communication link quality is good, it is permissible. Furthermore, thereby, the difference of the communication link quality in the cel of a base station BS 1 and the cel of a base station BS 2 can be made to be able to decrease, and the effectiveness as the whole system can be raised.

[0016] Hereafter, the gestalt of each operation for realizing control of such this invention is explained. Drawing 2 is drawing explaining the outline of the configuration in the gestalt of

operation of the 1st of the CDMA migration communication system of this invention. In this drawing, they are a mobile station in a software hand off field, and the base station which MS\_A connects with BS1 and BS2 connect with said mobile station (MS\_A). As mentioned above, the same signal is transmitted from base stations BS1 and BS2 for mobile station MS\_A located in a software hand off field. Transmitted power of the signal for mobile station MS\_A in each base station is set to TP1 and TP2, respectively. In mobile station MS\_A, the signal from both base stations is received, and those phases and time delays are amended and compounded. And the signal power after composition is measured and let the measured value be signal power RPt. Signal power RPt is measured with the reference value RPo beforehand set up as a power reference value. In the power control information generation section 1 of mobile station MS\_A, from both comparison, the transmitted power information (PC\_Inf) for raising transmitted power, when the signal power RPt is lower is created, when the signal power RPt is higher, the transmitted power information for lowering transmitted power is created, and as a drawing destructive line shows, it transmits to both the base stations BS1 and BS2 through an uphill circuit. Here, it is good also as a configuration which creates transmitted power information (PC\_Inf) based on the comparison result of the measured value of the communication link quality of the input signal after composition, and fixed criteria quality instead of comparing signal power RPt with a reference value RPo.

[0017] The mobile station power control sections (MS Power Control) 12, --, 13 which control the transmitted power to the mobile station linked to a local station, respectively, and 22, --, 23 shall be prepared in each base stations BS1 and BS2, the mobile station power control section 12 shall control transmitted power to said mobile station MS\_A by the base station BS 1, and the mobile station power control section 22 shall control transmitted power to said mobile station MS\_A by the base station BS 2. The transmitted power information (PC\_Inf) transmitted from said mobile station MS\_A is supplied to the mobile station power control sections 12 and 22, respectively, and each mobile station power control sections 12 and 22 update said transmitted power TP1 and TP2 of the signal for mobile station MS\_A transmitted from the signal transmitting sections (Signal Transmitter) 11 and 21 based on the received transmitted power information (PC\_Inf).

[0018] Moreover, the communication link quality of the signal received and compounded from each base station is measured to a mobile station (MS\_A), and the communication link quality information generation section (SIR Information) 2 which creates communication link quality information (SIR\_Inf) is formed in it, and it is constituted so that it may notify to the base station (BS1, BS2) which connects the this measured communication link quality information (SIR\_Inf). The base station control sections (BS Control) 14 and 24 are formed in the base station (BS1, BS2). These base station control sections 14 and 24 based on the communication link quality information (SIR\_Inf) notified from all the mobile stations linked to each In being worse than the certified value of the communication link quality of the going-down circuit as which the communication link quality in the base station which got down, calculated the communication link quality of a circuit, and was this calculated was determined beforehand As opposed to the mobile station power control section (MS Power Control) which has managed the mobile station in a software hand off condition It is constituted so that the instruction which forbids the increment beyond it of the transmitted power to the mobile station, or the instruction which decreases the transmitted power to the mobile station may be emitted. for example, difference with the certified value of the calculated communication link quality and said communication link quality - the increment in the transmitted power to the mobile station in a software hand off condition is forbidden, and when larger than the 2nd larger threshold than said 1st threshold, it is made to decrease the transmitted power to the mobile station in a software hand off condition, when a value is larger than the 1st threshold

[0019] Here, in mobile station MS\_A, it is assumed that the power of the received signal is weak, and transmitted power information (PC\_Inf) is transmitted to base stations BS1 and BS2 so that the transmitted power for local stations may be made to increase. At this time, the communication link quality in a base station BS 1 has deteriorated, and it considers as the thing in the base station BS 1 computed by the base station control section 14 in which it got down



and the communication link quality value of a circuit has deteriorated rather than the communication link QA value. In this case, the base station control section 14 transmits the instruction which decreases the transmitted power to the instruction or mobile station MS\_A which forbids the increment beyond it of the transmitted power to this mobile station MS\_A to the mobile station power control section 12 which has managed mobile station MS\_A which is in a software hand off condition among the mobile station power control sections 12, --, 13 which are performing power control of each mobile station. Consequently, from a base station BS 1, the transmitted power TP 1 of the signal for mobile station MS\_A transmitted will not be concerned with transmitted power information (PC\_Inf) from mobile station MS\_A, but will be fixed or decrease. Thus, by preparing a limit in the transmitted power to the mobile station in a software hand off condition, the increment in the total transmitted power in a base station BS 1 is controlled, and the control or the improvement of degradation beyond it of communication link quality in a base station BS 1 is achieved.

[0020] On the other hand, in the adjoining base station BS 2, the going-down circuit communication link quality presupposes that it is good. The transmitted power TP 2 of the signal for mobile station MS\_A is made to increase in a base station BS 2 based on the transmitted power information (PC\_Inf) from mobile station MS\_A at this time. That is, the base station BS 2 where communication link quality is good will pay many power to mobile station MS\_A of a software hand off condition instead of the base station BS 1 where communication link quality has deteriorated. In addition, although the total transmitted power will increase and that communication link quality will deteriorate as a result in a base station BS 2, it is permissible if it is within the limits of a certified value. Each base station performs the above actuation to the total displacement station in the connected software hand off field autonomously. Consequently, the communication link quality difference in base stations BS1 and BS2 is controlled.

[0021] Thus, it becomes possible by getting down and controlling the burden power to the mobile station in a software hand off field according to the communication link quality of a circuit to control the difference of the communication link quality between cels. In addition, in the above, although the transmitted power to the mobile station in a software hand off condition was controlled when the communication link quality value in each base station which got down, set up the certified value of the communication link quality of a circuit, and was computed deteriorated rather than this communication link QA value It replaces with said communication link QA value, and you may make it use the average of the communication link quality measured value in two or more base stations in the system concerned (for example, all base stations). Namely, what is necessary is just to control to control the transmitted power for the mobile stations in a software hand off condition as mentioned above, when the measured value of communication link quality deteriorates rather than the average of the communication link quality measured value in two or more base stations.

[0022] Next, the gestalt of operation of the 2nd of this invention is explained. Although a local station gets down from each base station based on the communication link quality information (SIR\_Inf) measured and notified with each mobile station linked to a local station and he was trying to compute the communication link quality in a circuit, he is trying for each base station to control the burden power to the mobile station in a software hand off field by the gestalt of implementation of the above 1st based on the total transmitted power value of a local station in the gestalt of this operation. The gestalt of operation of the 2nd of this invention is explained with reference to said drawing 2 . In addition, in the gestalt of this operation, the communication link quality information generation section 2 in said mobile station MS\_A does not need to prepare, and is made as [ transmit / to the base station control sections (BS Control) 14 and 24 in base stations BS1 and BS2 / the total transmitted power information (Total P\_Inf) which is total of transmitted power to each mobile station which that base station has connected from the signal transmitting sections (Signal Transmisster) 11 and 21 of that base station ].

[0023] In said base station control sections 14 and 24, this total transmitted power information (Total P\_Inf) will be judged that the communication link quality in the base station has deteriorated, if the total transmitted power notified from the signal transmitting sections 11 and

21 is this more than default as compared with the default of the total transmitted power set up beforehand. and in the base station control section (for example, base station control section 14 of a base station BS 1) judged that communication link quality has deteriorated The inside of the mobile station power control section (12, —, 13) which is performing power control of each mobile station, The instruction which forbids the increment beyond it of the transmitted power to this mobile station (MS\_A), or the instruction which decreases the transmitted power to a mobile station (MS\_A) is transmitted to the mobile station power control section (12) which has managed the mobile station (MS\_A) in a software hand off condition. Consequently, it turns a mobile station (MS\_A), and the transmitted power (TP1) of a signal will not be concerned with transmitted power information (PC\_Inf) from a mobile station (MS\_A), but will be fixed or decrease. In addition, you may make it the magnitude of a difference with the default of said total transmitted power determine whether the increment in the transmitted power to said mobile station (MS\_A) is forbidden, or it is made to decrease also in this case. Thus, by preparing a limit in the transmitted power to the mobile station in a software hand off condition, the increment in the total transmitted power in the base station judged that communication link quality has deteriorated is controlled, and control or an improvement of degradation beyond it of communication link quality is achieved.

[0024] On the other hand, there is little total transmitted power in an adjoining base station (BS2), it turns a mobile station (MS\_A) in a base station (BS2) according to the transmitted power information (PC\_Inf) that the increment in the transmitted power from a mobile station (MS\_A) is directed when [ that / circuit communication link quality ] getting down and it is good, and makes the transmitted power (TP2) of a signal increase from a default. That is, the base station (BS1) where communication link quality is good will pay many power to the mobile station (MS\_A) of a software hand off condition instead of the base station (BS1) where communication link quality has deteriorated. Although the total transmitted power will increase and communication link quality will deteriorate in a base station (BS2) at this time, it is permissible if it is within the limits of a certified value. Each base station performs the above actuation to the total displacement station in the connected software hand off field autonomously. Consequently, the communication link quality difference in base stations BS1 and BS2 is controlled.

[0025] Thus, it becomes possible by controlling the burden power [ as opposed to / get down and / the mobile station in a software hand off field according to the total transmitted power of a circuit ] in each base station to control the difference of the communication link quality between cels. Moreover, since it is not necessary in each mobile station to measure the communication link quality of the signal from each base station, and to notify communication link quality information (SIR\_Inf) to each base station according to the gestalt of this operation, it becomes possible to simplify the configuration of a mobile station.

[0026] In the gestalt of each operation mentioned above, although each base station controlled transmitted power autonomously, the control station which has jurisdiction [ base station ] is able to control collectively. Next, the gestalt of operation of the 3rd of this invention which the control station which has jurisdiction [ base station ] bundles up, and was controlled is explained. Drawing 3 is drawing showing the outline configuration of the 3rd of the gestalt of operation of this invention. In drawing 3, 30 is two or more base stations BS1, BS2, and BS3 and a control station (Control Station) which has jurisdiction [ — ]. In a control station 30, the communication link quality information (SIR\_Inf) computed as mentioned above than each of that base station it has jurisdiction [ base station ], or said total transmitted power information (Total P\_Inf) is received. The control station 30 which received communication link quality information or the total transmitted power information creates and transmits the power distribution information (Power Alloc\_Inf) forbids the increment beyond it of the transmitted power to the mobile station which has communication link quality in a software hand off condition to the base station which deteriorated below in the certified value, or the base station which the total transmitted power increased more than the default, or it directs that decreases the transmitted power to the mobile station.

[0027] The base station control section (BS Cotrol) of the base station where said power distribution information was transmitted transmits the instruction which decreases the

transmitted power to the instruction or this mobile station which forbids the increment beyond it of the transmitted power to this mobile station like the above-mentioned case to said mobile station power control section (MS Power Control) corresponding to the mobile station in the connected software hand off condition. By this, like the above-mentioned case, the increment in the total transmitted power in the base station judged that communication link quality has deteriorated will be controlled, and control or an improvement of degradation beyond it of communication link quality will be achieved. Moreover, the transmitted power to said mobile station is paid by the base station with the adjoining sufficient communication link quality, and the difference of the communication link quality between cells can be controlled.

[0028] Said control station in addition, as mentioned above It not only creates and transmits the power distribution information (Power Alloc\_Inf) which controls the transmitted power to the mobile station which is in a software hand off condition to the base station judged that communication link quality has deteriorated based on communication link quality information or the total transmitted power information, but You may make it create and transmit the power distribution information (Power Alloc\_Inf) directed to make the transmitted power to the mobile station in a software hand off condition increase to the base station contiguous to the base station.

[0029] Namely, said control station is based on the communication link quality information or the total transmitted power information transmitted from said each base station. a difference with the certified value of said communication link quality, or the default of the total transmitted power -- and Search for the communication link quality between adjoining base stations, or the difference of the total transmitted power, and it responds to the result. While creating and transmitting the power distribution information (Power Alloc\_Inf) that the increment beyond it of the transmitted power to the mobile station which is in a software hand off condition to the base station where communication link quality has deteriorated decreases prohibition or transmitted power The power distribution information (Power Alloc\_Inf) to which the transmitted power to the mobile station which is in a software hand off condition to the good base station of the communication link condition which adjoins the base station is made to increase is created and transmitted. Each base station will control transmitted power to the mobile station in a software hand off condition according to said power distribution information (Power Alloc\_Inf) transmitted to each.

[0030] In addition, said power distribution information (Power Alloc\_Inf) may be information which directs that only the specified quantity increases or decreases the transmitted power for the mobile stations in a software hand off condition, or may be informational any which specify the amount of the increment or reduction. Thus, according to the gestalt of this operation, the control station which has jurisdiction [ base station ] becomes possible [ opting for allocation of the power in each base station which it gets down and each base station pays to the mobile station in a software hand off field according to the communication link quality of a circuit ].

[0031] The gestalt of the operation of further others of this invention is explained using drawing 4 . In this drawing, they are a mobile station in a software hand off field, and the base station which MS\_A connects with BS1 and BS2 connect with said mobile station (MS\_A). As mentioned above, from base stations BS1 and BS2, the same signal is transmitted for mobile station MS\_A. Transmitted power of the signal for mobile station MS\_A in each base station is set to TP1 and TP2, respectively. In mobile station MS\_A, the signal from both base stations is received, and those phases and time delays are amended and compounded. Moreover, in case this composition is performed, in the communication link quality test section (SIR Measurement) 3, the communication link quality of each input signal is measured. SIR2t and communication link quality of the compound input signal are set [ the communication link quality of the input signal from the measured base station BS 1 ] to SIR1t for SIR1t and the communication link quality of the input signal from a base station BS 2.

[0032] The power control information generation section 1 in mobile station MS\_A compares the default SIRO of each communication link quality measured in said communication link quality test section 3, and the communication link quality set up beforehand, to two or more base stations BS1 and BS2 connected, creates transmitted power information PC\_Inf1 and PC\_Inf2 according

to an individual, and transmits it to each base station which corresponds through an uphill circuit, respectively. In said power control information generation section 1, when the comparison with the communication link quality  $SIR_t$  of the input signal after composition and Default  $SIR_o$  is performed and the communication link quality  $SIR_t$  of an input signal has deteriorated from Default  $SIR_o$ , communication link quality  $SIR_{1t}$  and  $SIR_{2t}$  of an input signal from each base station are measured. Consequently, when the difference of  $SIR_{1t}$  and  $SIR_{2t}$  is below a predetermined value, transmitted power information  $PC\_Inf1$  and  $PC\_Inf2$  which are directed to make the transmitted power for mobile station  $MS\_A$  increase, respectively are transmitted to both the base stations  $BS1$  and  $BS2$ .

[0033] Moreover, when the difference beyond a predetermined value is in communication link quality  $SIR_{1t}$  and  $SIR_{2t}$  of an input signal from said both base stations, the transmitted power information that it directs making the transmitted power turned a local station ( $MS\_A$ ) increase to the base station of the way with sufficient communication link quality, without transmitting transmitted power information to the base station of the direction whose communication link quality is not good is transmitted. For example, the number of mobile stations connected in a base station  $BS\ 1$  increases, and suppose that the total transmitted power increased. Since the total transmitted power in a base station has a fixed limit, a base station  $BS\ 1$  cannot assign sufficient transmitted power  $TP\ 1$  to mobile station  $MS\_A$ , but communication link quality  $SIR_{1t}$  of the signal from a base station  $BS\ 1$  deteriorates. The difference beyond a predetermined value occurs between communication link quality  $SIR_{1t}$  of the input signal from said both base stations  $BS1$  and  $BS2$ , and  $SIR_{2t}$ . In such a case, said power control information generation section 1 Transmitted power information ( $PC\_Inf1$ ) is not transmitted to a base station  $BS\ 1$ , but the transmitted power information ( $PC\_Inf2$ ) directed to make the transmitted power for local stations increase is transmitted only to the good base station  $BS\ 2$  of communication link quality.

[0034] Furthermore, the difference beyond the 2nd larger predetermined value than said predetermined value is in communication link quality  $SIR_{1t}$  of the input signal from said both base stations, and  $SIR_{2t}$ , and when the communication link quality of a certain base station has deteriorated very much, the transmitted power information it is directed that decreases the transmitted power for local stations is transmitted to the base station. For example, if the communication link quality of the signal from a base station  $BS\ 1$  shall have deteriorated very much, said power control information generation section 1 will transmit the transmitted power information ( $PC\_Inf1$ ) that it directs to decrease the transmitted power for local stations, to this base station  $BS\ 1$ . In addition, the transmitted power information ( $PC\_Inf2$ ) that it directs making the transmitted power for local stations increase like the above-mentioned is transmitted to the good base station  $BS\ 2$  of communication link quality.

[0035] On the other hand, when the communication link quality measured value  $SIR_t$  of an input signal is better than Default  $SIR_o$ , said power control information generation section 1 transmits the transmitted power information ( $PC\_Inf1$ ,  $PC\_Inf2$ ) that it directs to decrease the transmitted power turned a local station ( $MS\_A$ ), to the base stations  $BS1$  and  $BS2$  connected.

[0036] Moreover, said power control information generation section 1 also performs the comparison with communication link quality  $SIR_{1t}$  of the input signal from said each base station,  $SIR_{2t}$ , and Default  $SIR_o$ . And when it detects that the communication link quality of an input signal deteriorated beyond the predetermined value rather than the default, the transmitted power information that the transmitted power for local stations is decreased is transmitted to the base station which has transmitted the signal. For example, the number of mobile stations linked to a base station  $BS\ 1$  increases as mentioned above, and communication link quality  $SIR_{1t}$  of the input signal from a base station  $BS\ 1$  presupposes that it deteriorated beyond the predetermined value from Default  $SIR_o$ . At this time, it gets down, and judges that circuit communication link quality has deteriorated, and said power control information generation section 1 transmits the transmitted power information ( $PC\_Inf1$ ) it is directed that decreases the transmitted power for local stations to a base station  $BS\ 1$  in this base station  $BS\ 1$ . Thereby, said base station control section 14 of a base station  $BS\ 1$  publishes the instruction which decreases transmitted power to the transmitted power control section 12 corresponding to

mobile station MS\_A, and the transmitted power for mobile station MS\_A decreases. By this, the communication link quality SIR<sub>t</sub> of the input signal after the composition in mobile station MS\_A will deteriorate from said default SIR<sub>o</sub>. Therefore, the transmitted power information (PC\_Inf2) directed that said power control information generation section 1 makes transmitted power increase to a base station BS 2 as mentioned above is transmitted. In a base station BS 2, the transmitted power for mobile station MS\_A is increased according to this transmitted power information (PC\_Inf2).

[0037] Each mobile station performs the above actuation autonomously. Consequently, in the base station where communication link quality has deteriorated, the transmitted power to the mobile station of a software hand off condition is controlled, and degradation beyond it of communication link quality is controlled, or an improvement is achieved. On the other hand, in the good base station of communication link quality, the transmitted power to the mobile station of a software hand off condition increases. Consequently, the communication link quality difference between each cel is controlled. Thus, according to the gestalt of this operation, the mobile station in a software hand off condition becomes possible [controlling the difference between cels of communication link quality] by [of each base station to connect] getting down and giving the creation notice of the transmitted power information according to an individual according to the communication link quality of a circuit.

[0038] In addition, although he was trying to measure communication link quality SIR<sub>1t</sub> and SIR<sub>2t</sub> of an input signal from each base station by said communication link quality test section 3, it replaces with this and you may make it measure the total amount of interference of each signal from each base station which connects in the mobile station of a software hand off condition in the above. In this case, when the communication link quality SIR<sub>t</sub> of the input signal after composition deteriorates rather than a default, said power control-information generation section 1 does not create the transmitted power information over that base station, or creates and transmits the transmitted power information that the transmitted power information to which the transmitted power for local stations is made to increase to that base station, or the transmitted power for local stations is decreased, according to the amount of interference from each measured base station. Moreover, the transmitted power information it is directed that lowers transmitted power is created and transmitted to the base station where the measured amount of interference is large.

[0039] Moreover, you may make it said communication link quality test section 3 measure the communication link quality of each pilot signal always transmitted from each base station. In this case, when the communication link quality SIR<sub>t</sub> of the signal after composition deteriorates rather than a default, according to the communication link quality of the pilot signal from each measured base station, transmitted power information over that base station is not created, or the transmitted power information that the transmitted power information to which the transmitted power for local stations is made to increase to that base station, or the transmitted power for local stations is decreased is created and transmitted. Moreover, the transmitted power information it is directed that lowers the transmitted power for local stations is created and transmitted to the base station where the communication link quality of the measured pilot signal has deteriorated.

[0040] Furthermore, you may make it each base station report the going-down circuit communication link quality information in the base station computed by said base station control sections 14 and 24, or the total transmitted power information to each mobile station through a control channel etc. In this case, the mobile station of a software hand off condition gets down from each base station to connect, based on circuit communication link quality information or the total transmitted power information, creates the transmitted power information (PC\_Inf) on each base station, and notifies it to each base station. When the communication link quality of the input signal after composition deteriorates rather than a default, namely, the mobile station of a software hand off condition The base station or the total transmitted power with which it got down and circuit communication link quality has deteriorated [whether transmitted power information is transmitted to the base station which has reached the default, and] Or the transmitted power information that the transmitted power for local stations is decreased is

created and transmitted, and the transmitted power information which carries out the increment in transmitted power for local stations to the base station which has allowances in the good base station or the total transmitted power of communication link quality is created and transmitted. Moreover, the transmitted power information that it directs to lower the transmitted power for local stations is created and transmitted to the base station where it got down and circuit communication link quality information or the total transmitted power has reached the default. [0041]

[Effect of the Invention] As explained above, while according to the CDMA migration communication system of this invention becoming possible to control the burden rate of the transmitted power of two or more base stations of receiving the mobile station which gets down and is in a software hand off condition in a circuit and being able to control degradation of communication link quality, a system with few communication link quality differences which exist between cels is realizable.

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TECHNICAL FIELD

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[Field of the Invention] About code division multiple access (Code Division Multiple Access, henceforth, CDMA) migration communication system, it gets down and especially this invention relates to transmitted power control by the circuit.

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PRIOR ART

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[Description of the Prior Art] In recent years, the CDMA migration communication mode adapting spectrum spread system attracts attention. In the CDMA migration communication mode, since all stations use the same frequency, generally the software hand off is adopted. This software hand off is the technique of realizing a smooth hand off when the mobile station which is near a cel boundary connects with two or more base stations at coincidence, and it is the description that the hits of the communication link produced at the time of a hard hand off can be prevented. In a CDMA migration communication mode, since the same frequency is used, implementation of a software hand off is easy.

[0003] One method of the software hand off in a CDMA migration communication mode is explained with reference to drawing 5 . In drawing 5 , BS1, BS2, and BS3 show the base station, and the signal (it is called a pilot signal) for identifying the base station is always transmitted from each base station. A mobile station measures the received power of each pilot signal, and this received power chooses the greatest base station as a connection place base station. Among drawing, when pilot signal transmitted power in a base station BS 1 is set to PP1, the received power is expressed like  $PP1 \times R - K \times \alpha$ . Here, R shows attenuation according [ accord / the distance from a base station and K / an attenuation coefficient / alpha ] to a building etc.

[0004] The mobile station which exists near a cel boundary (location where the pilot signal received power from two or more adjoining base stations becomes the same) specifies two or more base stations as a connection place. Some following methods are proposed as the approach of this assignment. They are the method which selects the base station where lower limit  $L_{low}$  of software hand off level is set up in so that it may illustrate, and pilot signal received power becomes more than lower limit  $L_{low}$ , the method which selects the base station where upper-limit  $L_{up}$  of software hand off level is set up in so that it may illustrate, and pilot signal received power becomes between lower limit  $L_{low}$  and upper-limit  $L_{up}$ , or the method which prepares a limit in the time amount in a software hand off condition. In drawing 5 , the example of the method which selects the base station where pilot signal received power becomes more than lower limit  $L_{low}$  as a connection place is shown, and the field decided to be this appearance is made into the software hand off field.

[0005] Signal composition between the mobile station in a software hand off field and two or more base stations linked to the mobile station is performed as follows, for example. By the uphill circuit, it is received and the signal from the mobile station in a software hand off condition gets over in two or more base stations to connect. The signal to which it restored is transmitted to the control station (or exchange) which generalizes a base station. In a control station, the communication link quality or power of a signal sent from two or more base stations is measured, and communication link quality chooses the good or high signal of power. That is, in an uphill circuit, selection composition of the signal from the mobile station in a software hand off condition is carried out. The same signal is transmitted towards the mobile station in a software hand off condition from two or more base stations which it gets down and are connected by the circuit on the other hand. The phase of each signal and a time delay are amended and compounded in a mobile station. That is, it gets down and the maximum ratio composition of a



signal by which simultaneous transmission is carried out from two or more sets ground offices is performed by the circuit.

[0006] The former to the mobile station in such a software hand off condition gets down, and transmitted power control by the circuit is explained with reference to drawing 6 . In addition, such DS / a CDMA system that got down and used \*\*\*\*\*, Naomasa Yoshida, and "software handover about transmitted power control by the circuit get down, and it is indicated by circuit capacity" and 1995 year Institute of Electronics, Information and Communication Engineers communication link society convention SB-4-3. In drawing 6 , they are a mobile station in a software hand off field, and the base station which MS\_A connects with BS1 and BS2 connect with this mobile station MS\_A. From base stations BS1 and BS2, the same signal is transmitted for mobile station MS\_A. Transmitted power of the signal for MS\_A in each base station is set to TP1 and TP2. Generally TP1 and TP2 become this power. In mobile station MS\_A, the signal from both base stations is received, and those phases and time delays are amended and compounded. The signal power after composition is measured and it considers as signal power RPt. Signal power RPt is measured with the reference value RPo beforehand set up as a power reference value. In the power control information generation section (PC\_Inf) 1 of mobile station MS\_A, from both comparison, the transmitted power information (PC\_Inf) for raising transmitted power, when the signal power RPt is lower is created, when the signal power RPt is higher, the transmitted power information (PC\_Inf) for lowering transmitted power is created, and as a drawing destructive line shows, it transmits to each base stations BS1 and BS2 through an uphill circuit.

[0007] In the mobile station power control sections (MS Power Control) 12 and 22 which control the transmitted power to this mobile station MS\_A, based on the this transmitted transmitted power information (PC\_Inf), the transmitted power of the signal for mobile station MS\_A is controlled by each base stations BS1 and BS2, and the transmitted power TP1 and TP2 of the signal for mobile station MS\_A transmitted from the signal transmitting sections 11 and 21 is updated in them. Since the transmitted power information (PC\_Inf) transmitted to base stations BS1 and BS2 is common, the amount of updating of the signal power for mobile station MS\_A in each base station becomes the same, and it does not change that both the transmitted power TP1 and TP2 after updating is the same value. In addition, in the example shown in drawing 6 , although considered as the configuration which creates transmitted power information (PC\_Inf) by the comparison of the measured value RPt of the signal power after composition, and the reference electrode value RPo, it is good also as a configuration which measures the communication link quality of the signal after composition, compares this measured value with the criteria quality value set up beforehand, and creates the transmitted power information (PC\_Inf) mentioned above.

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EFFECT OF THE INVENTION

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[Effect of the Invention] As explained above, while according to the CDMA migration communication system of this invention becoming possible to control the burden rate of the transmitted power of two or more base stations of receiving the mobile station which gets down and is in a software hand off condition in a circuit and being able to control degradation of communication link quality, a system with few communication link quality differences which exist between cels is realizable.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] In actual migration communication system, since traffic volume (the number of mobile stations and total amount of the amount of data) is greatly influenced of the environments (a skyscraper, road, etc.) of the location, or population distribution and the configuration of a cel also becomes uneven for every cel, the traffic volume which one cel takes charge of serves as an ununiformity for every cel. Such heterogeneity produces the difference in the communication link quality between cels, and reduces the effectiveness as the whole system. Moreover, when a communication link quality difference is between cels in this way, it is not necessarily efficient that the base station to connect pays the same transmitted power to the mobile station in a software hand off field. That is, a software hand off field is near a cel boundary, and the mobile station location is distant from the base station, and it is expected that the interference from an adjoining base station is also large. For this reason, in a base station, large power will be paid to the mobile station of a software hand off condition. In the base station where it got down and the communication link quality of a circuit has deteriorated, carrying out a power burden to the mobile station in a software hand off field causes the further communication link quality degradation.

[0009] Then, this invention can lessen the communication link quality difference between cels, and aims at offering the CDMA migration communication system which can raise the effectiveness as the whole system while it gets down and it controls degradation of the communication link quality of a circuit.

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**MEANS**

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[Means for Solving the Problem] In order to attain the above-mentioned purpose, the CDMA migration communication system of this invention abolishes the difference of the communication link quality between said two or more base stations to the mobile station in a software hand off field in the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit by making the transmitted power from said two or more base stations to the mobile station in said software hand off field differ. Moreover, to the mobile station in a software hand off field, in the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit, when [ that ] it gets down and the communication link quality of a circuit has deteriorated, said base station is constituted so that a limit may be given to the transmitted power to the mobile station in said software hand off field linked to this base station.

[0011] Furthermore, to the mobile station in a software hand off field, in the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit, said base station is constituted so that a limit may be given to the transmitted power to the mobile station in said software hand off field which it gets down, and is connected with this base station when [ that ] the total transmitted power of a circuit is more than a default. In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again It gets down, and in the information about the communication link quality or its total transmitted power in a circuit, said each base station is constituted so that a base station may be transmitted to the control station which has jurisdiction. Said control station From each base station under the jurisdiction, get down and it is based on said information about the communication link quality or the total transmitted power in a circuit. It is constituted so that the information which controls the transmitted power to the mobile station in the software hand off field linked to the base station may be created and transmitted to said each base station.

[0012] In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again The mobile station in said software hand off field measures the communication link quality of the signal from said two or more base stations which have transmitted the same signal to a local station. It is constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations according to the measured this communication link quality. In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again The mobile station in said software hand off field measures the amount of interference from said two or more base stations which have transmitted the same signal to a local station. It is constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations according to the

measured this amount of interference.

[0013] In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again The mobile station in said software hand off field measures the communication link quality of the pilot signal from said two or more base stations which have transmitted the same signal to a local station. It is constituted so that the information which directs the change in transmitted power to a local station may be created and transmitted according to an individual to these two or more base stations according to the communication link quality of the measured this pilot signal. In the CDMA migration communication system considered as the configuration which gets down and transmits the same signal from two or more base stations by the circuit to the mobile station in a software hand off field further again Said each base station is constituted so that the information in a local station which gets down and shows circuit communication link quality or the total transmitted power of a local station may be reported to a mobile station. The mobile station in said software hand off field It is constituted so that the information which directs the change in said transmitted power [ as opposed to / get down and / based on circuit communication link quality or the total transmitted power / to these two or more base stations / a local station to an individual exception ] reported from said two or more base stations which have transmitted the same signal to a local station may be created and transmitted.

[0014]

[Embodiment of the Invention] First, with reference to drawing 1 , the situation of control of transmitted power to the mobile station in the software-off hand off field in the CDMA migration communication system of this invention is explained. In drawing 1 , the mobile station with which MS\_A is located in a software hand off field, and BS1 and BS2 are the base stations linked to this mobile station MS\_A. From base stations BS1 and BS2, the signal same for mobile station MS\_A is transmitted. A base station assigns transmitted power for [ each ] mobile stations so that all the mobile stations to connect may have the same going-down circuit communication link quality. As mentioned above, in mobile station MS\_A, the phase and time delay of the same signal which were received from base stations BS1 and BS2 are amended, and these are compounded and it receives. Although transmitted power required in order that the single base station which the mobile station has connected may satisfy predetermined communication link quality in that mobile station is paid when the mobile station is located in locations other than the inside of a software hand off field, when the mobile station is located in a software hand off field, two or more base stations which this mobile station connects will pay jointly.

[0015] Here, in the cel of a base station BS 1, there is little traffic volume and it gets down, and the communication link quality in a circuit is good, and by the cel of a base station BS 2, traffic volume increases and suppose that the communication link quality deteriorated. In such a case, in the former, mobile station MS\_A in a software hand off field is received. Both the base stations BS1 and BS2 linked to it pay transmitted power at same rate, and it sets to this invention to having been referred to as  $TP1=TP2$ . As  $TP1>TP2$ , it gets down, the burden rate of the good base station BS 1 of the communication link quality of a circuit is increased, and it controls to decrease the burden rate of a base station BS 2 that communication link quality deteriorated. Thus, by making the transmitted power from two or more base stations which receive the mobile station in a software hand off field differ, the transmitted power TP 2 for mobile station MS\_A in the base station BS 2 where it got down and the communication link quality in a circuit deteriorated can be decreased, and it becomes possible to improve degradation of the communication link quality in a base station BS 2. Moreover, reduction of the signal received power in mobile station MS\_A accompanying this can be compensated by the increment in the transmitted power TP 1 for mobile station MS\_A in the good base station BS 1 of communication link quality, and can secure predetermined communication link quality in mobile station MS\_A. In addition, in a base station BS 1, although it becomes degradation of some communication link quality by the increment in the transmitted power TP 1 for mobile station MS\_A, since the communication link quality is good, it is permissible. Furthermore, thereby, the difference of the communication link quality in the cel of a base station BS 1 and the cel of a

base station BS 2 can be made to be able to decrease, and the effectiveness as the whole system can be raised.

[0016] Hereafter, the gestalt of each operation for realizing control of such this invention is explained. Drawing 2 is drawing explaining the outline of the configuration in the gestalt of operation of the 1st of the CDMA migration communication system of this invention. In this drawing, they are a mobile station in a software hand off field, and the base station which MS\_A connects with BS1 and BS2 connect with said mobile station (MS\_A). As mentioned above, the same signal is transmitted from base stations BS1 and BS2 for mobile station MS\_A located in a software hand off field. Transmitted power of the signal for mobile station MS\_A in each base station is set to TP1 and TP2, respectively. In mobile station MS\_A, the signal from both base stations is received, and those phases and time delays are amended and compounded. And the signal power after composition is measured and let the measured value be signal power RPt. Signal power RPt is measured with the reference value RPo beforehand set up as a power reference value. In the power control information generation section 1 of mobile station MS\_A, from both comparison, the transmitted power information (PC\_Inf) for raising transmitted power, when the signal power RPt is lower is created, when the signal power RPt is higher, the transmitted power information for lowering transmitted power is created, and as a drawing destructive line shows, it transmits to both the base stations BS1 and BS2 through an uphill circuit. Here, it is good also as a configuration which creates transmitted power information (PC\_Inf) based on the comparison result of the measured value of the communication link quality of the input signal after composition, and fixed criteria quality instead of comparing signal power RPt with a reference value RPo.

[0017] The mobile station power control sections (MS Power Control) 12, —, 13 which control the transmitted power to the mobile station linked to a local station, respectively, and 22, —, 23 shall be prepared in each base stations BS1 and BS2, the mobile station power control section 12 shall control transmitted power to said mobile station MS\_A by the base station BS 1, and the mobile station power control section 22 shall control transmitted power to said mobile station MS\_A by the base station BS 2. The transmitted power information (PC\_Inf) transmitted from said mobile station MS\_A is supplied to the mobile station power control sections 12 and 22, respectively, and each mobile station power control sections 12 and 22 update said transmitted power TP1 and TP2 of the signal for mobile station MS\_A transmitted from the signal transmitting sections (Signal Transmitter) 11 and 21 based on the received transmitted power information (PC\_Inf).

[0018] Moreover, the communication link quality of the signal received and compounded from each base station is measured to a mobile station (MS\_A), and the communication link quality information generation section (SIR Information) 2 which creates communication link quality information (SIR\_Inf) is formed in it, and it is constituted so that it may notify to the base station (BS1, BS2) which connects the this measured communication link quality information (SIR\_Inf). The base station control sections (BS Control) 14 and 24 are formed in the base station (BS1, BS2). These base station control sections 14 and 24 based on the communication link quality information (SIR\_Inf) notified from all the mobile stations linked to each In being worse than the certified value of the communication link quality of the going-down circuit as which the communication link quality in the base station which got down, calculated the communication link quality of a circuit, and was this calculated was determined beforehand As opposed to the mobile station power control section (MS Power Control) which has managed the mobile station in a software hand off condition It is constituted so that the instruction which forbids the increment beyond it of the transmitted power to the mobile station, or the instruction which decreases the transmitted power to the mobile station may be emitted. for example, difference with the certified value of the calculated communication link quality and said communication link quality – the increment in the transmitted power to the mobile station in a software hand off condition is forbidden, and when larger than the 2nd larger threshold than said 1st threshold, it is made to decrease the transmitted power to the mobile station in a software hand off condition, when a value is larger than the 1st threshold

[0019] Here, in mobile station MS\_A, it is assumed that the power of the received signal is weak,

and transmitted power information (PC\_Inf) is transmitted to base stations BS1 and BS2 so that the transmitted power for local stations may be made to increase. At this time, the communication link quality in a base station BS 1 has deteriorated, and it considers as the thing in the base station BS 1 computed by the base station control section 14 in which it got down and the communication link quality value of a circuit has deteriorated rather than the communication link QA value. In this case, the base station control section 14 transmits the instruction which decreases the transmitted power to the instruction or mobile station MS\_A which forbids the increment beyond it of the transmitted power to this mobile station MS\_A to the mobile station power control section 12 which has managed mobile station MS\_A which is in a software hand off condition among the mobile station power control sections 12, —, 13 which are performing power control of each mobile station. Consequently, from a base station BS 1, the transmitted power TP 1 of the signal for mobile station MS\_A transmitted will not be concerned with transmitted power information (PC\_Inf) from mobile station MS\_A, but will be fixed or decrease. Thus, by preparing a limit in the transmitted power to the mobile station in a software hand off condition, the increment in the total transmitted power in a base station BS 1 is controlled, and the control or the improvement of degradation beyond it of communication link quality in a base station BS 1 is achieved.

[0020] On the other hand, in the adjoining base station BS 2, the going-down circuit communication link quality presupposes that it is good. The transmitted power TP 2 of the signal for mobile station MS\_A is made to increase in a base station BS 2 based on the transmitted power information (PC\_Inf) from mobile station MS\_A at this time. That is, the base station BS 2 where communication link quality is good will pay many power to mobile station MS\_A of a software hand off condition instead of the base station BS 1 where communication link quality has deteriorated. In addition, although the total transmitted power will increase and that communication link quality will deteriorate as a result in a base station BS 2, it is permissible if it is within the limits of a certified value. Each base station performs the above actuation to the total displacement station in the connected software hand off field autonomously. Consequently, the communication link quality difference in base stations BS1 and BS2 is controlled.

[0021] Thus, it becomes possible by getting down and controlling the burden power to the mobile station in a software hand off field according to the communication link quality of a circuit to control the difference of the communication link quality between cels. In addition, in the above, although the transmitted power to the mobile station in a software hand off condition was controlled when the communication link quality value in each base station which got down, set up the certified value of the communication link quality of a circuit, and was computed deteriorated rather than this communication link QA value It replaces with said communication link QA value, and you may make it use the average of the communication link quality measured value in two or more base stations in the system concerned (for example, all base stations). Namely, what is necessary is just to control to control the transmitted power for the mobile stations in a software hand off condition as mentioned above, when the measured value of communication link quality deteriorates rather than the average of the communication link quality measured value in two or more base stations.

[0022] Next, the gestalt of operation of the 2nd of this invention is explained. Although a local station gets down from each base station based on the communication link quality information (SIR\_Inf) measured and notified with each mobile station linked to a local station and he was trying to compute the communication link quality in a circuit, he is trying for each base station to control the burden power to the mobile station in a software hand off field by the gestalt of implementation of the above 1st based on the total transmitted power value of a local station in the gestalt of this operation. The gestalt of operation of the 2nd of this this invention is explained with reference to said drawing 2 . In addition, in the gestalt of this operation, the communication link quality information generation section 2 in said mobile station MS\_A does not need to prepare, and is made as [ transmit / to the base station control sections (BS Control) 14 and 24 in base stations BS1 and BS2 / the total transmitted power information (Total P\_Inf) which is total of transmitted power to each mobile station which that base station has connected from the signal transmitting sections (Signal Transmisster) 11 and 21 of that base

station ].

[0023] In said base station control sections 14 and 24, this total transmitted power information (Total P\_Inf) will be judged that the communication link quality in the base station has deteriorated, if the total transmitted power notified from the signal transmitting sections 11 and 21 is this more than default as compared with the default of the total transmitted power set up beforehand. and in the base station control section (for example, base station control section 14 of a base station BS 1) judged that communication link quality has deteriorated The inside of the mobile station power control section (12, —, 13) which is performing power control of each mobile station, The instruction which forbids the increment beyond it of the transmitted power to this mobile station (MS\_A), or the instruction which decreases the transmitted power to a mobile station (MS\_A) is transmitted to the mobile station power control section (12) which has managed the mobile station (MS\_A) in a software hand off condition. Consequently, it turns a mobile station (MS\_A), and the transmitted power (TP1) of a signal will not be concerned with transmitted power information (PC\_Inf) from a mobile station (MS\_A), but will be fixed or decrease. In addition, you may make it the magnitude of a difference with the default of said total transmitted power determine whether the increment in the transmitted power to said mobile station (MS\_A) is forbidden, or it is made to decrease also in this case. Thus, by preparing a limit in the transmitted power to the mobile station in a software hand off condition, the increment in the total transmitted power in the base station judged that communication link quality has deteriorated is controlled, and control or an improvement of degradation beyond it of communication link quality is achieved.

[0024] On the other hand, there is little total transmitted power in an adjoining base station (BS2), it turns a mobile station (MS\_A) in a base station (BS2) according to the transmitted power information (PC\_Inf) that the increment in the transmitted power from a mobile station (MS\_A) is directed when [ that / circuit communication link quality ] getting down and it is good, and makes the transmitted power (TP2) of a signal increase from a default. That is, the base station (BS1) where communication link quality is good will pay many power to the mobile station (MS\_A) of a software hand off condition instead of the base station (BS1) where communication link quality has deteriorated. Although the total transmitted power will increase and communication link quality will deteriorate in a base station (BS2) at this time, it is permissible if it is within the limits of a certified value. Each base station performs the above actuation to the total displacement station in the connected software hand off field autonomously. Consequently, the communication link quality difference in base stations BS1 and BS2 is controlled.

[0025] Thus, it becomes possible by controlling the burden power [ as opposed to / get down and / the mobile station in a software hand off field according to the total transmitted power of a circuit ] in each base station to control the difference of the communication link quality between cels. Moreover, since it is not necessary in each mobile station to measure the communication link quality of the signal from each base station, and to notify communication link quality information (SIR\_Inf) to each base station according to the gestalt of this operation, it becomes possible to simplify the configuration of a mobile station.

[0026] In the gestalt of each operation mentioned above, although each base station controlled transmitted power autonomously, the control station which has jurisdiction [ base station ] is able to control collectively. Next, the gestalt of operation of the 3rd of this invention which the control station which has jurisdiction [ base station ] bundles up, and was controlled is explained. Drawing 3 is drawing showing the outline configuration of the 3rd of the gestalt of operation of this invention. In drawing 3, 30 is two or more base stations BS1, BS2, and BS3 and a control station (Control Station) which has jurisdiction [ — ]. In a control station 30, the communication link quality information (SIR\_Inf) computed as mentioned above than each of that base station it has jurisdiction [ base station ], or said total transmitted power information (Total P\_Inf) is received. The control station 30 which received communication link quality information or the total transmitted power information creates and transmits the power distribution information (Power Alloc\_Inf) forbids the increment beyond it of the transmitted power to the mobile station which has communication link quality in a software hand off condition to the base station which deteriorated below in the certified value, or the base station which the total transmitted power



increased more than the default, or it directs that decreases the transmitted power to the mobile station.

[0027] The base station control section (BS Cotrol) of the base station where said power distribution information was transmitted transmits the instruction which decreases the transmitted power to the instruction or this mobile station which forbids the increment beyond it of the transmitted power to this mobile station like the above-mentioned case to said mobile station power control section (MS Power Control) corresponding to the mobile station in the connected software hand off condition. By this, like the above-mentioned case, the increment in the total transmitted power in the base station judged that communication link quality has deteriorated will be controlled, and control or an improvement of degradation beyond it of communication link quality will be achieved. Moreover, the transmitted power to said mobile station is paid by the base station with the adjoining sufficient communication link quality, and the difference of the communication link quality between cels can be controlled.

[0028] Said control station in addition, as mentioned above It not only creates and transmits the power distribution information (Power Alloc\_Inf) which controls the transmitted power to the mobile station which is in a software hand off condition to the base station judged that communication link quality has deteriorated based on communication link quality information or the total transmitted power information, but You may make it create and transmit the power distribution information (Power Alloc\_Inf) directed to make the transmitted power to the mobile station in a software hand off condition increase to the base station contiguous to the base station.

[0029] Namely, said control station is based on the communication link quality information or the total transmitted power information transmitted from said each base station. a difference with the certified value of said communication link quality, or the default of the total transmitted power — and Search for the communication link quality between adjoining base stations, or the difference of the total transmitted power, and it responds to the result. While creating and transmitting the power distribution information (Power Alloc\_Inf) that the increment beyond it of the transmitted power to the mobile station which is in a software hand off condition to the base station where communication link quality has deteriorated decreases prohibition or transmitted power The power distribution information (Power Alloc\_Inf) to which the transmitted power to the mobile station which is in a software hand off condition to the good base station of the communication link condition which adjoins the base station is made to increase is created and transmitted. Each base station will control transmitted power to the mobile station in a software hand off condition according to said power distribution information (Power Alloc\_Inf) transmitted to each.

[0030] In addition, said power distribution information (Power Alloc\_Inf) may be information which directs that only the specified quantity increases or decreases the transmitted power for the mobile stations in a software hand off condition, or may be informational any which specify the amount of the increment or reduction. Thus, according to the gestalt of this operation, the control station which has jurisdiction [ base station ] becomes possible [ opting for allocation of the power in each base station which it gets down and each base station pays to the mobile station in a software hand off field according to the communication link quality of a circuit ].

[0031] The gestalt of the operation of further others of this invention is explained using drawing 4 . In this drawing, they are a mobile station in a software hand off field, and the base station which MS\_A connects with BS1 and BS2 connect with said mobile station (MS\_A). As mentioned above, from base stations BS1 and BS2, the same signal is transmitted for mobile station MS\_A. Transmitted power of the signal for mobile station MS\_A in each base station is set to TP1 and TP2, respectively. In mobile station MS\_A, the signal from both base stations is received, and those phases and time delays are amended and compounded. Moreover, in case this composition is performed, in the communication link quality test section (SIR Measurement) 3, the communication link quality of each input signal is measured. SIR2t and communication link quality of the compound input signal are set [ the communication link quality of the input signal from the measured base station BS 1 ] to SIRt for SIR1t and the communication link quality of the input signal from a base station BS 2.

[0032] The power control information generation section 1 in mobile station MS\_A compares the default SIRo of each communication link quality measured in said communication link quality test section 3, and the communication link quality set up beforehand, to two or more base stations BS1 and BS2 connected, creates transmitted power information PC\_Inf1 and PC\_Inf2 according to an individual, and transmits it to each base station which corresponds through an uphill circuit, respectively. In said power control information generation section 1, when the comparison with the communication link quality SIRt of the input signal after composition and Default SIRo is performed and the communication link quality SIRt of an input signal has deteriorated from Default SIRo, communication link quality SIR1t and SIR2t of an input signal from each base station are measured. Consequently, when the difference of SIR1t and SIR2t is below a predetermined value, transmitted power information PC\_Inf1 and PC\_Inf2 which are directed to make the transmitted power for mobile station MS\_A increase, respectively are transmitted to both the base stations BS1 and BS2.

[0033] Moreover, when the difference beyond a predetermined value is in communication link quality SIR1t and SIR2t of an input signal from said both base stations, the transmitted power information that it directs making the transmitted power turned a local station (MS\_A) increase to the base station of the way with sufficient communication link quality, without transmitting transmitted power information to the base station of the direction whose communication link quality is not good is transmitted. For example, the number of mobile stations connected in a base station BS 1 increases, and suppose that the total transmitted power increased. Since the total transmitted power in a base station has a fixed limit, a base station BS 1 cannot assign sufficient transmitted power TP 1 to mobile station MS\_A, but communication link quality SIR1t of the signal from a base station BS 1 deteriorates. The difference beyond a predetermined value occurs between communication link quality SIR1t of the input signal from said both base stations BS1 and BS2, and SIR2t. In such a case, said power control information generation section 1 Transmitted power information (PC\_Inf1) is not transmitted to a base station BS 1, but the transmitted power information (PC\_Inf2) directed to make the transmitted power for local stations increase is transmitted only to the good base station BS 2 of communication link quality.

[0034] Furthermore, the difference beyond the 2nd larger predetermined value than said predetermined value is in communication link quality SIR1t of the input signal from said both base stations, and SIR2t, and when the communication link quality of a certain base station has deteriorated very much, the transmitted power information it is directed that decreases the transmitted power for local stations is transmitted to the base station. For example, if the communication link quality of the signal from a base station BS 1 shall have deteriorated very much, said power control information generation section 1 will transmit the transmitted power information (PC\_Inf1) that it directs to decrease the transmitted power for local stations, to this base station BS 1. In addition, the transmitted power information (PC\_Inf2) that it directs making the transmitted power for local stations increase like the above-mentioned is transmitted to the good base station BS 2 of communication link quality.

[0035] On the other hand, when the communication link quality measured value SIRt of an input signal is better than Default SIRo, said power control information generation section 1 transmits the transmitted power information (PC\_Inf1, PC\_Inf2) that it directs to decrease the transmitted power turned a local station (MS\_A), to the base stations BS1 and BS2 connected.

[0036] Moreover, said power control information generation section 1 also performs the comparison with communication link quality SIR1t of the input signal from said each base station, SIR2t, and Default SIRo. And when it detects that the communication link quality of an input signal deteriorated beyond the predetermined value rather than the default, the transmitted power information that the transmitted power for local stations is decreased is transmitted to the base station which has transmitted the signal. For example, the number of mobile stations linked to a base station BS 1 increases as mentioned above, and communication link quality SIR1t of the input signal from a base station BS 1 presupposes that it deteriorated beyond the predetermined value from Default SIRo. At this time, it gets down, and judges that circuit communication link quality has deteriorated, and said power control information generation

section 1 transmits the transmitted power information (PC\_Inf1) it is directed that decreases the transmitted power for local stations to a base station BS 1 in this base station BS 1. Thereby, said base station control section 14 of a base station BS 1 publishes the instruction which decreases transmitted power to the transmitted power control section 12 corresponding to mobile station MS\_A, and the transmitted power for mobile station MS\_A decreases. By this, the communication link quality SIR<sub>t</sub> of the input signal after the composition in mobile station MS\_A will deteriorate from said default SIR<sub>o</sub>. Therefore, the transmitted power information (PC\_Inf2) directed that said power control information generation section 1 makes transmitted power increase to a base station BS 2 as mentioned above is transmitted. In a base station BS 2, the transmitted power for mobile station MS\_A is increased according to this transmitted power information (PC\_Inf2).

[0037] Each mobile station performs the above actuation autonomously. Consequently, in the base station where communication link quality has deteriorated, the transmitted power to the mobile station of a software hand off condition is controlled, and degradation beyond it of communication link quality is controlled, or an improvement is achieved. On the other hand, in the good base station of communication link quality, the transmitted power to the mobile station of a software hand off condition increases. Consequently, the communication link quality difference between each cel is controlled. Thus, according to the gestalt of this operation, the mobile station in a software hand off condition becomes possible [controlling the difference between cels of communication link quality] by [of each base station to connect] getting down and giving the creation notice of the transmitted power information according to an individual according to the communication link quality of a circuit.

[0038] In addition, although he was trying to measure communication link quality SIR<sub>1t</sub> and SIR<sub>2t</sub> of an input signal from each base station by said communication link quality test section 3, it replaces with this and you may make it measure the total amount of interference of each signal from each base station which connects in the mobile station of a software hand off condition in the above. In this case, when the communication link quality SIR<sub>t</sub> of the input signal after composition deteriorates rather than a default, said power control-information generation section 1 does not create the transmitted power information over that base station, or creates and transmits the transmitted power information that the transmitted power information to which the transmitted power for local stations is made to increase to that base station, or the transmitted power for local stations is decreased, according to the amount of interference from each measured base station. Moreover, the transmitted power information it is directed that lowers transmitted power is created and transmitted to the base station where the measured amount of interference is large.

[0039] Moreover, you may make it said communication link quality test section 3 measure the communication link quality of each pilot signal always transmitted from each base station. In this case, when the communication link quality SIR<sub>t</sub> of the signal after composition deteriorates rather than a default, according to the communication link quality of the pilot signal from each measured base station, transmitted power information over that base station is not created, or the transmitted power information that the transmitted power information to which the transmitted power for local stations is made to increase to that base station, or the transmitted power for local stations is decreased is created and transmitted. Moreover, the transmitted power information it is directed that lowers the transmitted power for local stations is created and transmitted to the base station where the communication link quality of the measured pilot signal has deteriorated.

[0040] Furthermore, you may make it each base station report the going-down circuit communication link quality information in the base station computed by said base station control sections 14 and 24, or the total transmitted power information to each mobile station through a control channel etc. In this case, the mobile station of a software hand off condition gets down from each base station to connect, based on circuit communication link quality information or the total transmitted power information, creates the transmitted power information (PC\_Inf) on each base station, and notifies it to each base station. When the communication link quality of the input signal after composition deteriorates rather than a default, namely, the mobile station

of a software hand off condition The base station or the total transmitted power with which it got down and circuit communication link quality has deteriorated [ whether transmitted power information is transmitted to the base station which has reached the default, and ] Or the transmitted power information that the transmitted power for local stations is decreased is created and transmitted, and the transmitted power information which carries out the increment in transmitted power for local stations to the base station which has allowances in the good base station or the total transmitted power of communication link quality is created and transmitted. Moreover, the transmitted power information that it directs to lower the transmitted power for local stations is created and transmitted to the base station where it got down and circuit communication link quality information or the total transmitted power has reached the default.

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[Translation done.]

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is drawing for explaining fundamental actuation of the CDMA migration communication system of this invention.

[Drawing 2] It is drawing showing the outline configuration of the 1st of the gestalt of operation of the CDMA migration communication system of this invention.

[Drawing 3] It is drawing showing the outline configuration of the gestalt of other operations of the CDMA migration communication system of this invention.

[Drawing 4] It is drawing of the CDMA migration communication system of this invention showing the outline configuration of the gestalt of other operations further.

[Drawing 5] It is drawing for explaining a software hand off.

[Drawing 6] It is drawing for explaining the conventional CDMA migration communication system.

[Description of Notations]

MS\_A Mobile station

BS1, BS2 Base station

PC\_Inf Transmitted power information

Power Alloc\_Inf Power distribution information

SIR\_Inf Communication link quality information

Total P\_Inf The total transmitted power information

1 Power Control Information Generation Section

2 Communication Link Quality Information Generation Section

3 Communication Link Quality Test Section

11 21 Signal transmitting section

12, 13, 22, 23 Mobile station power control section

14 24 Base station control section

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[Translation done.]

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開2001-244878

(P2001-244878A)

(43) 公開日 平成13年9月7日(2001.9.7)

(51) Int.Cl. <sup>7</sup>	識別記号	F I	テーマコード(参考)
H 0 4 B 7/26	1 0 2	H 0 4 B 7/26	1 0 2 5 K 0 2 2
H 0 4 J 13/04		H 0 4 J 13/00	G 5 K 0 6 7
H 0 4 Q 7/22		H 0 4 Q 7/04	K
7/28			

審査請求 有 請求項の数 8 O L (全 11 頁)

(21) 出願番号 特願2000-56880(P2000-56880)

(22) 出願日 平成12年3月2日(2000.3.2)

特許法第30条第1項適用申請有り 1999年9月19日～9月22日開催の「Gateway to 21st Century Communications Village VTC 1999-Fall」において文書をもって発表

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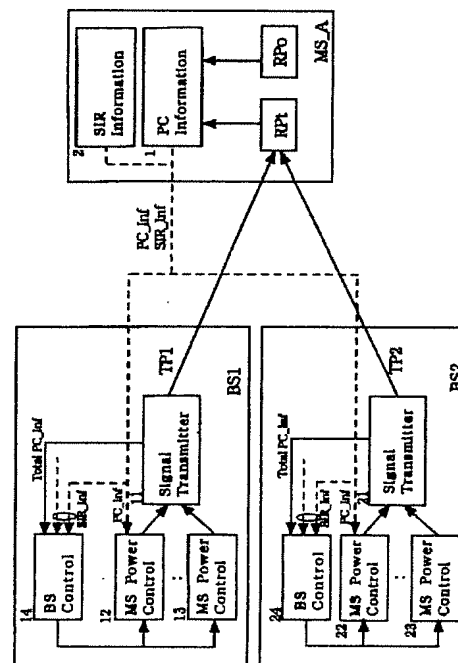
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(54) 【発明の名称】 CDMA移動通信システム

(57) 【要約】

【課題】 トラヒックや無線環境に不均一性がある場合、下り回線における通信品質のセル間差を抑制する。

【解決手段】 ソフトハンドオフ領域内の移動局MS<sub>A</sub>に対し、複数の基地局BS1、BS2が同一の信号を送信する。移動局は、各基地局からの信号を合成し受信するとともに、各基地局に対し受信信号の通信品質情報SIR<sub>Inf</sub>を送信する。基地局BS1、BS2の基地局制御部14、24は、下り回線の通信品質が劣化しているとき、ソフトハンドオフ領域内の移動局に対応する移動局電力制御部12、22に対し、送信電力を抑制するよう制御する。移動局の受信信号電力RP<sub>0</sub>が既定値RP<sub>0</sub>以下となり、送信電力の増加を指示する信号PC<sub>Inf</sub>を基地局BS1、BS2に伝送しても、下り回線の通信品質が劣化した基地局は移動局向けの送信電力を抑制しており、通信品質の良好な基地局が移動局向けの送信電力を負担する。移動局に対する送信電力の負担割合を制御することで、セル間に存在する通信品質差を抑制することができる。



## 【特許請求の範囲】

【請求項1】 ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記ソフトハンドオフ領域内の移動局に対する前記複数の基地局からの送信電力を異ならしめることにより、前記複数の基地局間における通信品質の差をなくすようにしたことを特徴とするCDMA移動通信システム。

【請求項2】 ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記基地局は、その下り回線の通信品質が劣化しているとき、該基地局と接続する前記ソフトハンドオフ領域内の移動局に対する送信電力に制限を与えるように構成されていることを特徴とするCDMA移動通信システム。

【請求項3】 ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記基地局は、その下り回線の総送信電力が既定値以上であるとき、該基地局と接続する前記ソフトハンドオフ領域内の移動局に対する送信電力に制限を与えるように構成されていることを特徴とするCDMA移動通信システム。

【請求項4】 ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記各基地局はその下り回線での通信品質あるいはその総送信電力に関する情報を基地局を管轄する制御局に伝送するように構成されており、前記制御局は、その管轄下にある各基地局からの前記下り回線での通信品質あるいは総送信電力に関する情報に基づいて、前記各基地局に対し、その基地局と接続するソフトハンドオフ領域内の移動局に対する送信電力を制御する情報を作成し伝送するように構成されていることを特徴とするCDMA移動通信システム。

【請求項5】 ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記ソフトハンドオフ領域内の移動局は、自局に対して同一の信号を送信している前記複数の基地局からの信号の通信品質を測定し、該測定した通信品質に応じて、該複数の基地局に対し、個別に、自局に対する送信電力の増減を指示する情報を作成し伝送するように構成されていることを特徴とするCDMA移動通信システム。

【請求項6】 ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記ソフトハンドオフ領域内の移動局は、自局に対して同一の信号を送信している前記複数の基地局からの干渉量を測定し、該測定した干渉量に応じて、該複数の基地

局に対し、個別に、自局に対する送信電力の増減を指示する情報を作成し伝送するように構成されていることを特徴とするCDMA移動通信システム。

【請求項7】 ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記ソフトハンドオフ領域内の移動局は、自局に対して同一の信号を送信している前記複数の基地局からのパイロット信号の通信品質を測定し、該測定したパイロット信号の通信品質に応じて、該複数の基地局に対し、個別に、自局に対する送信電力の増減を指示する情報を作成し伝送するように構成されていることを特徴とするCDMA移動通信システム。

【請求項8】 ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記各基地局は自局における下り回線通信品質または自局の総送信電力を示す情報を移動局に報知するよう構成され、

前記ソフトハンドオフ領域内の移動局は、自局に対して同一の信号を送信している前記複数の基地局から報知された前記下り回線通信品質または総送信電力に基づいて、該複数の基地局に対し、個別に、自局に対する送信電力の増減を指示する情報を作成し伝送するように構成されていることを特徴とするCDMA移動通信システム。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、符号分割多元接続（Code Division Multiple Access、以下CDMA）移動通信システムに関し、特に下り回線での送信電力制御に関するものである。

【0002】

【従来の技術】近年、スペクトル拡散方式を応用したCDMA移動通信方式が注目されている。CDMA移動通信方式では、全局が同一の周波数を用いることから、ソフトハンドオフが一般的に採用されている。このソフトハンドオフは、セル境界付近にいる移動局が同時に複数の基地局と接続することによってスムーズなハンドオフを実現する技術であり、ハードハンドオフ時に生じる通信の瞬断が防げることが特徴である。CDMA移動通信方式では、同一の周波数を用いることから、ソフトハンドオフの実現が容易である。

【0003】CDMA移動通信方式におけるソフトハンドオフの一方式について、図5を参照して説明する。図5において、BS1、BS2、BS3は基地局を示しており、各基地局からは、その基地局を識別するための信号（パイロット信号という）が常時送信される。移動局は、各パイロット信号の受信電力を比較し、該受信電力が最大の基地局を接続先基地局として選択する。図中、基地局BS

1におけるパイロット信号送信電力を $PP1$ とすると、その受信電力は、 $PP1 \times R^{-K} \times \alpha$ のように表される。ここで、 $R$ は基地局からの距離、 $K$ は減衰定数、 $\alpha$ は建物等による減衰を示す。

【0004】セル境界（隣接する複数の基地局からのパイロット信号受信電力が同一となる位置）付近に存在する移動局は、複数の基地局を接続先として指定する。この指定の方法として、次のような幾つかの方式が提案されている。図示するようにソフトハンドオフレベルの下  
10 限値 $L_{low}$ を設定し、パイロット信号受信電力が下限値 $L_{low}$ 以上となる基地局を選定する方式、図示するようにソフトハンドオフレベルの上限値 $L_{up}$ を設定し、パイ  
ロット信号受信電力が下限値 $L_{low}$ と上限値 $L_{up}$ の間となる基地局を選定する方式、あるいは、ソフトハンドオフ  
状態にある時間に制限を設ける方式などである。図5では、パイロット信号受信電力が下限値 $L_{low}$ 以上となる  
基地局を接続先として選定する方式の例を示しており、この様に決められる領域をソフトハンドオフ領域として  
いる。

【0005】ソフトハンドオフ領域内の移動局と、その  
20 移動局と接続する複数の基地局との間の信号合成は、例えば、次のように行われる。上り回線では、ソフト  
ハンドオフ状態にある移動局からの信号は、接続する複数の  
基地局で受信され、復調される。復調された信号は、基  
地局を統括する制御局（または、交換機）に伝送され  
る。制御局では、複数の基地局から送られる信号の通信  
品質または電力を比較し、通信品質が良いまたは電力の  
高い信号を選択する。即ち、上り回線において、ソフト  
ハンドオフ状態にある移動局からの信号は選択合成され  
る。一方、下り回線では、接続する複数の基地局より同  
30 一の信号が、ソフトハンドオフ状態にある移動局に向け  
送信される。移動局では、各信号の位相、遅延時間を補  
正し、合成する。即ち、下り回線では、複数基地局から  
同時送信される信号の最大比合成が行われる。

【0006】このようなソフトハンドオフ状態にある移  
動局に対する、従来の下り回線での送信電力制御につい  
て、図6を参照して説明する。なお、このような下り回  
線での送信電力制御については、濱辺孝二郎、吉田尚  
正、「ソフトハンドオーバーを用いたDS/CDMAシス  
テムの下り回線容量」、1995年電子情報通信学会通  
信ソサイエティ大会SB-4-3に記載されている。図  
6において、 $MS_A$ はソフトハンドオフ領域内の移動局、  
BS1、BS2は該移動局 $MS_A$ と接続する基地局である。基地  
局BS1、BS2からは、移動局 $MS_A$ 向けに同一信号が送信さ  
れる。各基地局での $MS_A$ 向け信号の送信電力を $TP1$ 、 $TP2$   
とする。一般的に $TP1$ 、 $TP2$ は同電力となる。移動局 $MS_A$   
では、両基地局からの信号を受信し、それらの位相およ  
び遅延時間を補正し、合成する。合成後の信号電力を測  
定し、信号電力 $R_{Pt}$ とする。信号電力 $R_{Pt}$ は、電力基準値  
として予め設定されている基準値 $R_{Po}$ と比較される。移  
50

動局 $MS_A$ の電力制御情報生成部（PC Information）1では、両者の比較より、信号電力 $R_{Pt}$ の方が低い場合は送信電力を上げるための送信電力情報（PC\_Inf）を作成し、信号電力 $R_{Pt}$ の方が高い場合は送信電力を下げるための送信電力情報（PC\_Inf）を作成し、図中破線で示すように、上り回線を通して各基地局BS1、BS2に伝達する。

【0007】各基地局BS1、BS2では、該移動局 $MS_A$ に対する送信電力を制御する移動局電力制御部（MS Power Control）12、22において、該伝達された送信電力情報（PC\_Inf）を基に、移動局 $MS_A$ 向け信号の送信電力を制御し、信号送信部11、21から送信される移動局 $MS_A$ 向け信号の送信電力 $TP1$ 、 $TP2$ を更新する。基地局BS1、BS2に伝達される送信電力情報（PC\_Inf）が共通であるため、各基地局における移動局 $MS_A$ 向け信号電力の更新量は同じとなり、更新後の両送信電力 $TP1$ 、 $TP2$ が同じ値であることはわからない。なお、図6に示した例においては、合成後の信号電力の測定値 $R_{Pt}$ と基準電力値 $R_{Po}$ の比較により送信電力情報（PC\_Inf）を作成する構成としているが、合成後の信号の通信品質を測定し、該測定値と予め設定されている基準品質値とを比較して、前述した送信電力情報（PC\_Inf）を作成する構成としてもよい。

【0008】

【発明が解決しようとする課題】実際の移动通信システムでは、トラヒック量（移動局数やデータ量の総量）は、その場所の環境（高層ビルや道路等）や人口分布の影響を大きく受け、また、セルの形状もセル毎に不均一となることから、1セルが受け持つトラヒック量はセル毎に不均一となる。この様な不均一性は、セル間での通信品質の差異を生じ、システム全体としての効率を低下させる。また、このようにセル間に通信品質差がある場合、ソフトハンドオフ領域内にある移動局に対し、接続する基地局が同一の送信電力を負担することは必ずしも効率的ではない。すなわち、ソフトハンドオフ領域はセル境界付近にあり、その移動局位置は基地局から離れており、かつ隣接基地局からの干渉も大きいことが予想される。このため、基地局では、ソフトハンドオフ状態の移動局に対し、大電力を負担することになる。下り回線の通信品質が劣化している基地局では、ソフトハンドオフ領域内の移動局に対して電力負担をすることは、更なる通信品質劣化の原因となる。

【0009】そこで、本発明は、下り回線の通信品質の劣化を抑制するとともに、セル間での通信品質差を少なくすることができ、システム全体としての効率を向上させることのできるCDMA移动通信システムを提供することを目的としている。

【0010】

【課題を解決するための手段】上記目的を達成するため、本発明のCDMA移动通信システムは、ソフトハン



ドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記ソフトハンドオフ領域内の移動局に対する前記複数の基地局からの送信電力を異ならしめることにより、前記複数の基地局間における通信品質の差をなくすようにしたものである。また、ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記基地局は、その下り回線の通信品質が劣化しているとき、該基地局と接続する前記ソフトハンドオフ領域内の移動局に対する送信電力に制限を与えるように構成されているものである。

【0011】さらに、ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記基地局は、その下り回線の総送信電力が既定値以上であるとき、該基地局と接続する前記ソフトハンドオフ領域内の移動局に対する送信電力に制限を与えるように構成されているものである。さらにまた、ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記各基地局はその下り回線での通信品質あるいはその総送信電力に関する情報を基地局を管轄する制御局に伝送するように構成されており、前記制御局は、その管轄下にある各基地局からの前記下り回線での通信品質あるいは総送信電力に関する情報に基づいて、前記各基地局に対し、その基地局と接続するソフトハンドオフ領域内の移動局に対する送信電力を制御する情報を作成し伝送するように構成されているものである。

【0012】さらにまた、ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記ソフトハンドオフ領域内の移動局は、自局に対して同一の信号を送信している前記複数の基地局からの信号の通信品質を測定し、該測定した通信品質に応じて、該複数の基地局に対し、個別に、自局に対する送信電力の増減を指示する情報を作成し伝送するように構成されているものである。さらにまた、ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記ソフトハンドオフ領域内の移動局は、自局に対して同一の信号を送信している前記複数の基地局からの干渉量を測定し、該測定した干渉量に応じて、該複数の基地局に対し、個別に、自局に対する送信電力の増減を指示する情報を作成し伝送するように構成されているものである。

【0013】さらにまた、ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおい

て、前記ソフトハンドオフ領域内の移動局は、自局に対して同一の信号を送信している前記複数の基地局からのパイロット信号の通信品質を測定し、該測定したパイロット信号の通信品質に応じて、該複数の基地局に対し、個別に、自局に対する送信電力の増減を指示する情報を作成し伝送するように構成されているものである。さらにまた、ソフトハンドオフ領域内の移動局に対し、下り回線で複数の基地局より同一の信号を送信する構成とされたCDMA移動通信システムにおいて、前記各基地局は自局における下り回線通信品質または自局の総送信電力を示す情報を移動局に報知するよう構成され、前記ソフトハンドオフ領域内の移動局は、自局に対して同一の信号を送信している前記複数の基地局から報知された前記下り回線通信品質または総送信電力に基づいて、該複数の基地局に対し、個別に、自局に対する送信電力の増減を指示する情報を作成し伝送するように構成されているものである。

【0014】

【発明の実施の形態】まず、図1を参照して、本発明のCDMA移動通信システムにおけるソフトハンドオフ領域内の移動局に対する送信電力の制御の様子について説明する。図1において、MS\_Aはソフトハンドオフ領域内に位置する移動局、BS1、BS2は該移動局MS\_Aに接続する基地局である。基地局BS1、BS2からは、移動局MS\_A向けに同一の信号が送信される。基地局は、接続する全ての移動局が同一の下り回線通信品質を持つように各移動局向けに送信電力を割り当てる。前述のように、移動局MS\_Aでは、基地局BS1およびBS2から受信した同一の信号の位相および遅延時間を補正し、これらを合成して受信する。移動局がソフトハンドオフ領域内以外の場所に位置しているときは、移動局が接続している単一の基地局がその移動局において所定の通信品質を満足するために必要な送信電力を負担するが、移動局がソフトハンドオフ領域内に位置しているときには、この移動局が接続する複数の基地局が共同して負担することとなる。

【0015】ここで、基地局BS1のセルでは、トラヒック量が少なく、下り回線での通信品質が良好であり、基地局BS2のセルでは、トラヒック量が多くなり、その通信品質が劣化したとする。このような場合に、従来においては、ソフトハンドオフ領域内の移動局MS\_Aに対して、それに接続する両基地局BS1、BS2が同一の割合で送信電力を負担し、 $TP1=TP2$ とされていたのに対し、本発明においては、 $TP1>TP2$ として、下り回線の通信品質の良好な基地局BS1の負担割合を増加し、通信品質が劣化した基地局BS2の負担割合を減少させるように制御する。このようにソフトハンドオフ領域内の移動局に対する複数の基地局からの送信電力を異ならしめることにより、下り回線での通信品質の劣化した基地局BS2における移動局MS\_A向けの送信電力TP2を減少させることができ、基地局BS2における通信品質の劣化を改善すること

が可能となる。また、これにともなう移動局MS<sub>A</sub>における信号受信電力の減少は、通信品質の良好な基地局BS1における移動局MS<sub>A</sub>向けの送信電力TP1の増加により補償することができ、移動局MS<sub>A</sub>において所定の通信品質を確保することができる。なお、基地局BS1においては、移動局MS<sub>A</sub>向けの送信電力TP1の増加により若干の通信品質の劣化となるが、その通信品質が良好であるため、許容することができる。さらに、これにより、基地局BS1のセルと、基地局BS2のセルにおける通信品質の差を減少させることとなり、システム全体としての効率を向上させることができる。

【0016】以下、このような本発明の制御を実現するための各実施の形態について説明する。図2は、本発明のCDMA移動通信システムの第1の実施の形態における構成の概要を説明する図である。この図において、MS<sub>A</sub>はソフトハンドオフ領域内の移動局、BS1、BS2は前記移動局(MS<sub>A</sub>)と接続する基地局である。前述のように、基地局BS1、BS2から、ソフトハンドオフ領域内に位置する移動局MS<sub>A</sub>向けに同一信号が送信される。各基地局での移動局MS<sub>A</sub>向け信号の送信電力を、それぞれ、TP1、TP2とする。移動局MS<sub>A</sub>では、両基地局からの信号を受信し、それらの位相および遅延時間を補正し、合成する。そして、合成後の信号電力を測定し、その測定値を信号電力R<sub>Pt</sub>とする。信号電力R<sub>Pt</sub>は、予め電力基準値として設定されている基準値R<sub>Pb</sub>と比較される。移動局MS<sub>A</sub>の電力制御情報生成部1では、両者の比較より、信号電力R<sub>Pt</sub>の方が低い場合は送信電力を上げるための送信電力情報(PC<sub>Inf</sub>)を作成し、信号電力R<sub>Pt</sub>の方が高い場合は送信電力を下げるための送信電力情報を作成し、

図中破線で示すように、上り回線を通して両基地局BS1、BS2に伝達する。ここで、信号電力R<sub>Pt</sub>と基準値R<sub>Pb</sub>とを比較する代わりに、合成後の受信信号の通信品質の測定値と既定の基準品質との比較結果に基づいて送信電力情報(PC<sub>Inf</sub>)を作成する構成としてもよい。

【0017】各基地局BS1およびBS2には、それぞれ、自局に接続している移動局に対する送信電力を制御する移動局電力制御部(MS Power Control)12、…、13および22、…、23が設けられており、基地局BS1では移動局電力制御部12が前記移動局MS<sub>A</sub>に対する送信電力の制御を行い、基地局BS2では移動局電力制御部22が前記移動局MS<sub>A</sub>に対する送信電力の制御を行うものとする。前記移動局MS<sub>A</sub>から伝達された送信電力情報(PC<sub>Inf</sub>)は、それぞれ移動局電力制御部12、22に供給され、各移動局電力制御部12、22は、受信した送信電力情報(PC<sub>Inf</sub>)を基に、信号送信部(Signal Transmitter)11、21から送信される前記移動局MS<sub>A</sub>向け信号の送信電力TP1、TP2を更新する。

【0018】また、移動局(MS<sub>A</sub>)には、各基地局から受信し合成した信号の通信品質を測定して、通信品質情報(SIR<sub>Inf</sub>)を作成する通信品質情報生成部(SIR Inf

ormation)2が設けられており、該測定した通信品質情報(SIR<sub>Inf</sub>)を接続する基地局(BS1、BS2)に通知するよう構成されている。基地局(BS1、BS2)には基地局制御部(BS Control)14、24が設けられている。該基地局制御部14、24は、それぞれに接続する全ての移動局から通知される通信品質情報(SIR<sub>Inf</sub>)をもとに、その基地局における下り回線の通信品質を算定し、該算定された通信品質が予め定められた下り回線の通信品質の保証値よりも悪い場合には、ソフトハンドオフ状態にある移動局を管理している移動局電力制御部(MS Power Control)に対し、その移動局に対する送信電力のそれ以上の増加を禁止する命令、あるいは、その移動局に対する送信電力を減少させる命令を発するよう構成されている。例えば、算定された通信品質と前記通信品質の保証値との差分値が、第1の閾値よりも大きいときは、ソフトハンドオフ状態にある移動局に対する送信電力の増加を禁止し、前記第1の閾値よりも大きい第2の閾値よりも大きいときには、ソフトハンドオフ状態にある移動局に対する送信電力を減少させるようにする。

【0019】ここで、移動局MS<sub>A</sub>では、受信した信号の電力が弱く、自局向けの送信電力を増加させるよう送信電力情報(PC<sub>Inf</sub>)を基地局BS1、BS2に伝送していると仮定する。このとき、基地局BS1での通信品質が劣化しており、基地局制御部14で算出した基地局BS1での下り回線の通信品質値が通信品質保証値よりも劣化しているものとする。この場合には、基地局制御部14は、各移動局の電力制御を行っている移動局電力制御部12、…、13のうちソフトハンドオフ状態にある移動局MS<sub>A</sub>を管理している移動局電力制御部12に対し、該移動局MS<sub>A</sub>に対する送信電力のそれ以上の増加を禁止する命令あるいは移動局MS<sub>A</sub>に対する送信電力を減少させる命令を伝達する。この結果、基地局BS1から送信される移動局MS<sub>A</sub>向け信号の送信電力TP1は、移動局MS<sub>A</sub>からの送信電力情報(PC<sub>Inf</sub>)に関わらず、一定または減少することになる。このように、ソフトハンドオフ状態にある移動局への送信電力に制限を設けることで、基地局BS1での総送信電力の増加が抑制され、基地局BS1における通信品質のそれ以上の劣化の抑制または改善が図られる。

【0020】一方、隣接する基地局BS2では、その下り回線通信品質が良好であるとする。このとき、移動局MS<sub>A</sub>からの送信電力情報(PC<sub>Inf</sub>)に基づき、基地局BS2では移動局MS<sub>A</sub>向け信号の送信電力TP2を増加させる。即ち、通信品質が良好な基地局BS2が、通信品質の劣化している基地局BS1の代わりに、ソフトハンドオフ状態の移動局MS<sub>A</sub>に対する電力を多く負担することになる。なお、この結果、基地局BS2では総送信電力が増加し、その通信品質が劣化することとなるが、保証値の範囲内であれば許容することができる。以上の動作を各基地局が自律的に、接続しているソフトハンドオフ領域内の全

移動局に対して行う。この結果、基地局BS1とBS2での通信品質差が抑制される。

【0021】このように、下り回線の通信品質に応じて、ソフトハンドオフ領域内の移動局に対する負担電力を制御することにより、セル間の通信品質の差を抑制することが可能となる。なお、上記においては、各基地局での下り回線の通信品質の保証値を設定し、算出した通信品質値が該通信品質保証値よりも劣化したときに、ソフトハンドオフ状態にある移動局に対する送信電力を抑制するようにしたが、前記通信品質保証値に代えて、当該システム内の複数の基地局（例えば、全基地局）における通信品質測定値の平均値を用いるようにしてもよい。すなわち、通信品質の測定値が、複数の基地局における通信品質測定値の平均値よりも劣化したとき、前述のように、ソフトハンドオフ状態にある移動局向けの送信電力を抑制するように制御すればよい。

【0022】次に、本発明の第2の実施の形態について説明する。上記第1の実施の形態では、各基地局は、自局に接続している各移動局で測定され通知される通信品質情報（SIR\_Inf）に基づいて、自局の下り回線での通信品質を算出するようにしていたが、この実施の形態においては、各基地局は、自局の総送信電力値をもとに、ソフトハンドオフ領域内の移動局に対する負担電力を制御するようにしている。この本発明の第2の実施の形態について、前記図2を参照して説明する。なお、この実施の形態においては、前記移動局MS\_Aにおける通信品質情報生成部2は設ける必要はなく、基地局BS1、BS2における基地局制御部（BS Control）14、24には、その基地局の信号送信部（Signal Transmitter）11、21からその基地局が接続している各移動局に対する送信電力の総和である総送信電力情報（Total P\_Inf）が伝達されるようになされている。

【0023】前記基地局制御部14、24では、該総送信電力情報（Total P\_Inf）を予め設定されている総送信電力の既定値と比較し、信号送信部11、21から通知された総送信電力が該既定値以上であれば、その基地局での通信品質が劣化していると判断する。そして、通信品質が劣化していると判断した基地局制御部（例えば、基地局BS1の基地局制御部14）では、各移動局の電力制御を行っている移動局電力制御部（12、…、13）のうち、ソフトハンドオフ状態にある移動局（MS\_A）を管理している移動局電力制御部（12）に対し、該移動局（MS\_A）に対する送信電力のそれ以上の増加を禁止する命令、または、移動局（MS\_A）に対する送信電力を減少させる命令を伝達する。この結果、移動局（MS\_A）向け信号の送信電力（TP1）は、移動局（MS\_A）からの送信電力情報（PC\_Inf）に関わらず、一定または減少することになる。なお、この場合においても、前記移動局（MS\_A）に対する送信電力の増加を禁止するか、あるいは減少させるかを、前記総送信電力の既定値との差

の大きさにより決定するようにしてもよい。このように、ソフトハンドオフ状態にある移動局への送信電力に制限を設けることで、通信品質が劣化していると判断された基地局での総送信電力の増加が抑制され、通信品質のそれ以上の劣化の抑制または改善が図られる。

【0024】一方、隣接する基地局（BS2）での総送信電力が既定値よりも少なく、その下り回線通信品質が良好であるとした場合、移動局（MS\_A）からの送信電力の増加を指示する送信電力情報（PC\_Inf）に応じて、基地局（BS2）では移動局（MS\_A）向け信号の送信電力（TP2）を増加させる。即ち、通信品質が良好である基地局（BS1）が、通信品質の劣化している基地局（BS1）に代わって、ソフトハンドオフ状態の移動局（MS\_A）に対する電力を多く負担することになる。このとき、基地局（BS2）では総送信電力が増加し、通信品質が劣化することとなるが、保証値の範囲内であれば許容することができる。以上の動作を各基地局が自律的に、接続しているソフトハンドオフ領域内の全移動局に対して行う。この結果、基地局BS1とBS2での通信品質差が抑制される。

【0025】このように、各基地局における下り回線の総送信電力に応じて、ソフトハンドオフ領域内の移動局に対する負担電力を制御することにより、セル間の通信品質の差を抑制することが可能となる。また、この実施の形態によれば、各移動局において、各基地局からの信号の通信品質を測定し、通信品質情報（SIR\_Inf）を各基地局に通知する必要がないので、移動局の構成を簡略化することが可能となる。

【0026】上述した各実施の形態においては、各基地局が自律的に送信電力を制御するものであったが、基地局を管轄する制御局が一括して制御することも可能である。次に、基地局を管轄する制御局が一括して制御するようにした本発明の第3の実施の形態について説明する。図3は、本発明の第3の実施の形態の概略構成を示す図である。図3において、30は複数の基地局BS1、BS2、BS3、…を管轄する制御局（Control Station）である。制御局30では、その管轄する各基地局より、前述のようにして算出した通信品質情報（SIR\_Inf）、または、前記総送信電力情報（Total P\_Inf）を受け取る。通信品質情報または総送信電力情報を受け取った制御局30は、通信品質が保証値以下に劣化した基地局、または、総送信電力が既定値以上に増加した基地局に対し、ソフトハンドオフ状態にある移動局に対する送信電力のそれ以上の増加を禁止する、または、その移動局に対する送信電力を減少させるよう指示する電力分配情報（Power Alloc\_Inf）を作成し伝達する。

【0027】前記電力分配情報が伝達された基地局の基地局制御部（BS Control）は、前述の場合と同様に、その接続しているソフトハンドオフ状態にある移動局に対応する前記移動局電力制御部（MS Power Control）に対し、該移動局に対する送信電力のそれ以上の増加を禁止

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する命令あるいは該移動局に対する送信電力を減少させる命令を伝達する。これにより、前述の場合と同様に、通信品質が劣化していると判断された基地局での総送信電力の増加が抑制され、通信品質のそれ以上の劣化の抑制または改善が図られることとなる。また、隣接する通信品質の良い基地局により、前記移動局に対する送信電力が負担され、セル間の通信品質の差を抑制することができる。

【0028】なお、前記制御局は、前述のように、通信品質情報あるいは総送信電力情報に基づいて通信品質が劣化していると判断された基地局に対してソフトハンドオフ状態にある移動局に対する送信電力を抑制する電力分配情報 (Power Alloc\_Inf) を作成し伝達するだけでなく、その基地局に隣接する基地局に対し、ソフトハンドオフ状態にある移動局に対する送信電力を増加させるよう指示する電力分配情報 (Power Alloc\_Inf) を作成し伝達するようにしてもよい。

【0029】すなわち、前記制御局は、前記各基地局より伝送されるその通信品質情報あるいは総送信電力情報に基づき、前記通信品質の保証値あるいは総送信電力の既定値との差、および、隣接する基地局間の通信品質あるいは総送信電力の差を求め、その結果に応じて、通信品質の劣化している基地局に対してはソフトハンドオフ状態にある移動局に対する送信電力のそれ以上の増加を禁止あるいは送信電力を減少させる電力分配情報 (Power Alloc\_Inf) を作成して伝達するとともに、その基地局に隣接している通信状態の良好な基地局に対してはソフトハンドオフ状態にある移動局に対する送信電力を増加させる電力分配情報 (Power Alloc\_Inf) を作成して伝達する。各基地局は、それぞれに伝達された前記電力分配情報 (Power Alloc\_Inf) に従って、ソフトハンドオフ状態にある移動局に対する送信電力の制御を行うこととなる。

【0030】なお、前記電力分配情報 (Power Alloc\_Inf) は、ソフトハンドオフ状態にある移動局向けの送信電力を所定量だけ増加あるいは減少させることを指示する情報であってもよく、あるいは、その増加あるいは減少の量を指定する情報のいずれであってもよい。このように、この実施の形態によれば、基地局を管轄する制御局が、各基地局での下り回線の通信品質に応じて、ソフトハンドオフ領域内の移動局に対して各基地局が負担する電力の配分を決定することが可能となる。

【0031】本発明のさらに他の実施の形態について、図4を用いて説明する。この図において、MS\_Aはソフトハンドオフ領域内の移動局、BS1、BS2は前記移動局 (MS\_A) と接続する基地局である。前述のように、基地局BS1、BS2からは、移動局MS\_A向けに同一信号が送信される。各基地局での移動局MS\_A向け信号の送信電力を、それぞれ、TP1、TP2とする。移動局MS\_Aでは、両基地局からの信号を受信し、それらの位相および遅延時間を補正

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し、合成する。また、この合成を行う際、通信品質測定部 (SIR Measurement) 3 において、各受信信号の通信品質を測定する。測定した基地局BS1からの受信信号の通信品質をSIR1t、基地局BS2からの受信信号の通信品質をSIR2t、合成した受信信号の通信品質をSIRtとする。

【0032】移動局MS\_Aにおける電力制御情報生成部1は、前記通信品質測定部3において測定した各通信品質と予め設定されている通信品質の既定値SIRoとを比較して、接続されている複数の基地局BS1およびBS2に対し、それぞれ個別に送信電力情報PC\_Inf1およびPC\_Inf2を作成し、上り回線を通じて対応する各基地局に伝達する。前記電力制御情報生成部1において、合成後の受信信号の通信品質SIRtと既定値SIRoとの比較を行い、受信信号の通信品質SIRtが既定値SIRoよりも劣化しているときは、各基地局からの受信信号の通信品質SIR1tとSIR2tとを比較する。この結果、SIR1tとSIR2tとの差が所定値以下であるときには、両基地局BS1およびBS2に対し、それぞれ、移動局MS\_A向けの送信電力を増加させるように指示する送信電力情報PC\_Inf1およびPC\_Inf2を伝達する。

【0033】また、前記両基地局からの受信信号の通信品質SIR1tとSIR2tに所定値以上の差があるときには、通信品質の良くない方の基地局に対しては送信電力情報を伝達せずに、通信品質の良いほうの基地局に対し、自局 (MS\_A) 向けの送信電力を増加させることを指示する送信電力情報を送信する。例えば、基地局BS1で、接続する移動局数が増え、その総送信電力が増加したとする。基地局における総送信電力には一定の制限があるため、基地局BS1は、移動局MS\_Aに対し、十分な送信電力TP1を割当てることが出来ず、基地局BS1からの信号の通信品質SIR1tは劣化する。このような場合には、前記両基地局BS1、BS2からの受信信号の通信品質SIR1tとSIR2tとの間には所定値以上の差が発生し、前記電力制御情報生成部1は、基地局BS1に対しては送信電力情報 (PC\_Inf1) を伝達せず、通信品質の良好な基地局BS2に対してのみ、自局向けの送信電力を増加させるように指示する送信電力情報 (PC\_Inf2) を伝達する。

【0034】さらに、前記両基地局からの受信信号の通信品質SIR1t、SIR2tに前記所定値よりも大きい第2の所定値以上の差があり、ある基地局の通信品質が非常に劣化している場合には、その基地局に対し、自局向けの送信電力を減少させるように指示する送信電力情報を伝達する。例えば、基地局BS1からの信号の通信品質が非常に劣化しているものとする、前記電力制御情報生成部1は、該基地局BS1に対し、自局向けの送信電力を減少させることを指示する送信電力情報 (PC\_Inf1) を伝達する。なお、通信品質の良好な基地局BS2には前述と同様に自局向けの送信電力を増加させることを指示する送信電力情報 (PC\_Inf2) を伝達する。

【0035】一方、受信信号の通信品質測定値SIRtが既定値SIRoよりも良いときには、前記電力制御情報生成部

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1は、接続されている基地局BS1、BS2に対し、自局（MS<sub>A</sub>）向けの送信電力を減少させることを指示する送信電力情報（PC\_Inf1、PC\_Inf2）を送信する。

【0036】また、前記電力制御情報生成部1は、前記各基地局からの受信信号の通信品質SIR1t、SIR2tと既定値SIRoとの比較も行う。そして、受信信号の通信品質が既定値よりも所定値以上劣化したことを検出したときに、その信号を送信している基地局に対し、自局向けの送信電力を減少させる送信電力情報を送信する。例えば、前述のように、基地局BS1に接続する移動局数が増え、基地局BS1からの受信信号の通信品質SIR1tが既定値SIRoより所定値以上劣化したとする。このとき、前記電力制御情報生成部1は、この基地局BS1での下り回線通信品質が劣化していると判断し、基地局BS1に対し自局向けの送信電力を減少させるよう指示する送信電力情報（PC\_Inf1）を送信する。これにより、基地局BS1の前記基地局制御部14は、移動局MS<sub>A</sub>に対応する送信電力制御部12に対し、送信電力を減少させる命令を発行し、移動局MS<sub>A</sub>向けの送信電力は減少する。これにより、移動局MS<sub>A</sub>における合成後の受信信号の通信品質SIRが前記既定値SIRoよりも劣化することとなる。したがって、前述のように、前記電力制御情報生成部1は、基地局BS2に対し、送信電力を増加させるように指示する送信電力情報（PC\_Inf2）を送信する。基地局BS2では、この送信電力情報（PC\_Inf2）に従って、移動局MS<sub>A</sub>向けの送信電力を増加する。

【0037】以上の動作を各移動局が自律的におこなう。この結果、通信品質の劣化している基地局では、ソフトハンドオフ状態の移動局に対する送信電力が抑制され、通信品質のそれ以上の劣化が抑制され、または改善が図られる。一方、通信品質の良好な基地局では、ソフトハンドオフ状態の移動局に対する送信電力が増加する。この結果、各セル間での通信品質差が抑制される。このように、この実施の形態によれば、ソフトハンドオフ状態にある移動局が、接続する各基地局の下り回線の通信品質に応じて、個別に送信電力情報を作成通知することにより、通信品質のセル間差を抑制することが可能となる。

【0038】なお、上記においては、ソフトハンドオフ状態の移動局において、前記通信品質測定部3により各基地局からの受信信号の通信品質SIR1tおよびSIR2tを測定するようにしていたが、これに代えて、接続する各基地局からの信号それぞれの総干渉量を測定するようにしてもよい。この場合、合成後の受信信号の通信品質SIRtが既定値よりも劣化した場合に、前記電力制御情報生成部1は、測定した各基地局からの干渉量に応じて、その基地局に対する送信電力情報を作成しなかったり、その基地局に対し自局向けの送信電力を増加させる送信電力情報あるいは自局向けの送信電力を減少させる送信電力情報を作成し伝送する。また、測定した干渉量の大きい

基地局に対して、送信電力を下げるよう指示する送信電力情報を作成し伝送する。

【0039】また、前記通信品質測定部3は、各基地局から常時送信されているパイロット信号それぞれの通信品質を測定するようにしてもよい。この場合には、合成後の信号の通信品質SIRtが既定値よりも劣化したときに、測定した各基地局からのパイロット信号の通信品質に応じて、その基地局に対する送信電力情報を作成しなかったり、その基地局に対し自局向けの送信電力を増加させる送信電力情報あるいは自局向けの送信電力を減少させる送信電力情報を作成し伝送する。また、測定したパイロット信号の通信品質が劣化している基地局に対して、自局向けの送信電力を下げるよう指示する送信電力情報を作成し伝送する。

【0040】さらに、各基地局が、前記基地局制御部14、24で算出したその基地局での下り回線通信品質情報または総送信電力情報を制御チャネル等を通じて各移動局に報知するようにしてもよい。この場合、ソフトハンドオフ状態の移動局は、接続する各基地局からの下り回線通信品質情報または総送信電力情報をもとに、各基地局への送信電力情報（PC\_Inf）を作成し、各基地局に通知する。すなわち、合成後の受信信号の通信品質が既定値よりも劣化した場合に、ソフトハンドオフ状態の移動局は、下り回線通信品質の劣化している基地局あるいは総送信電力が既定値に達している基地局に対しては送信電力情報を伝送しないか、あるいは、自局向けの送信電力を減少させる送信電力情報を作成して伝送し、通信品質の良好な基地局あるいは総送信電力に余裕のある基地局に対しては自局向けの送信電力増加させる送信電力情報を作成して伝送する。また、下り回線通信品質情報または総送信電力が既定値に達している基地局に対し、自局向けの送信電力を下げることを指示する送信電力情報を作成し伝送する。

【0041】

【発明の効果】以上説明したように、本発明のCDMA移動通信システムによれば、下り回線において、ソフトハンドオフ状態にある移動局に対する複数の基地局の送信電力の負担割合を制御することが可能となり、通信品質の劣化を抑制することができるとともに、セル間に存在する通信品質差が少ないシステムを実現することができる。

【図面の簡単な説明】

【図1】 本発明のCDMA移動通信システムの基本的な動作を説明するための図である。

【図2】 本発明のCDMA移動通信システムの第1の実施の形態の概略構成を示す図である。

【図3】 本発明のCDMA移動通信システムの他の実施の形態の概略構成を示す図である。

【図4】 本発明のCDMA移動通信システムのさらに他の実施の形態の概略構成を示す図である。

【図5】 ソフトハンドオフについて説明するための図である。

【図6】 従来のCDMA移動通信システムについて説明するための図である。

【符号の説明】

MS\_A 移動局

BS1、BS2 基地局

PC\_Inf 送信電力情報

Power Alloc\_Inf 電力分配情報

\* SIR\_Inf 通信品質情報

Total P\_Inf 総送信電力情報

1 電力制御情報生成部

2 通信品質情報生成部

3 通信品質測定部

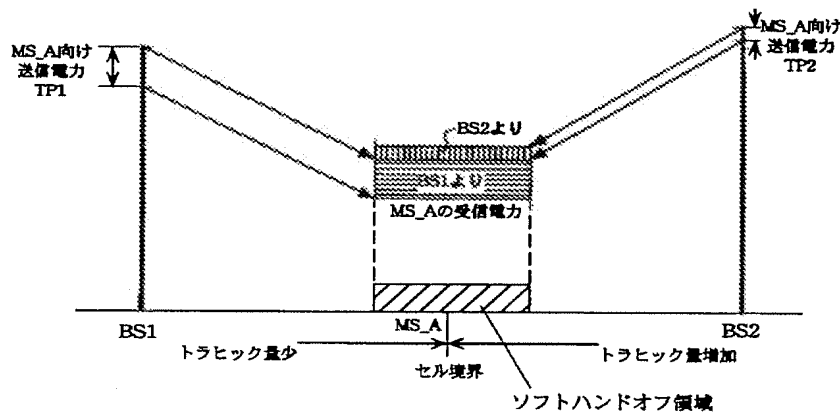
11、21 信号送信部

12、13、22、23 移動局電力制御部

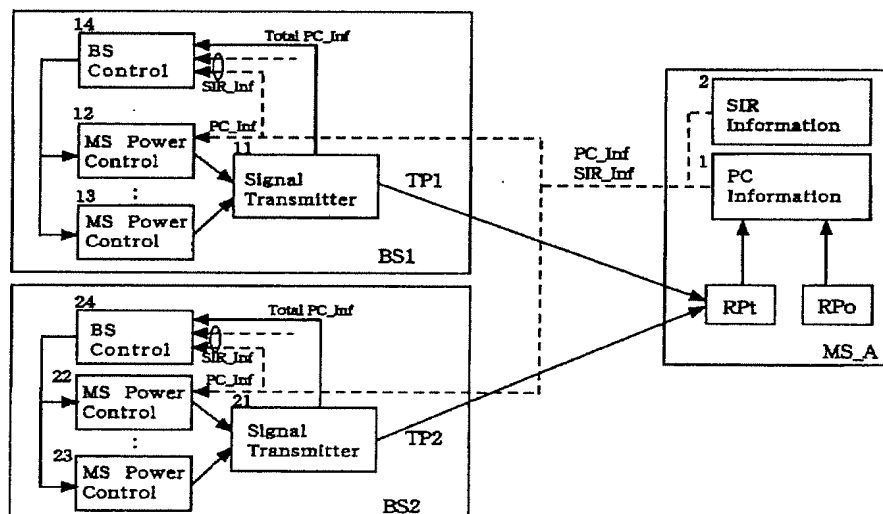
14、24 基地局制御部

\*

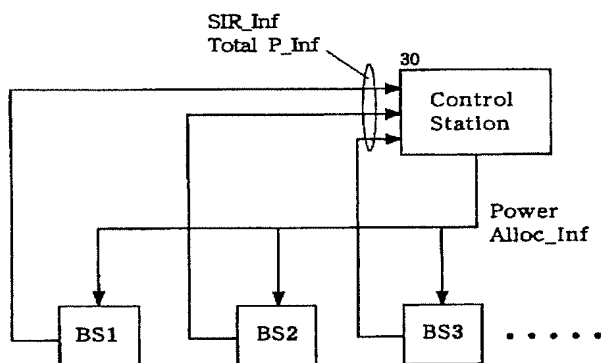
【図1】



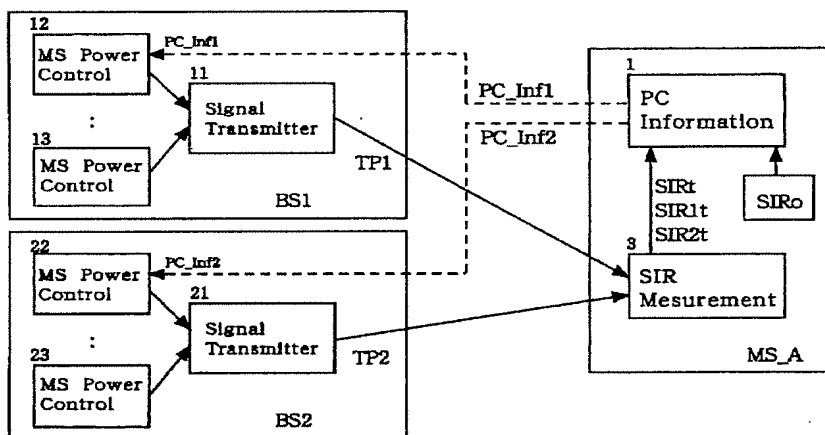
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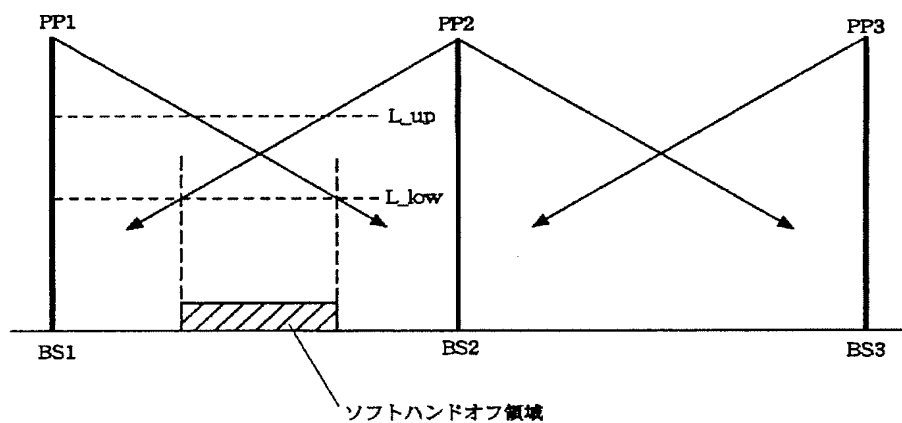
【図 3】



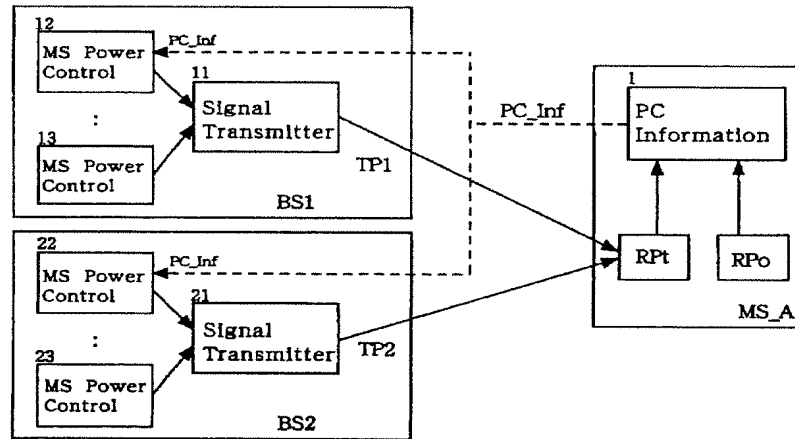
【図 4】



【図 5】



【図6】



フロントページの続き

Fターム(参考) 5K022 EE01 EE12 EE21 EE31  
 5K067 AA03 AA23 CC10 CC24 DD11  
 DD43 DD45 DD47 EE02 EE10  
 EE16 EE24 GG08 GG09 JJ35  
 JJ39